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Small and medium sized physician practices (SMPP) are medical practices that consist of a staff of less than 10 physicians. Nearly 60% of the US physicians work in SMPP and face more barriers to HIT adoption and implementation than their larger counterparts. The dissertation is on the use and impact of Health Information Technology (HIT) on SMPP. The dissertation will also explore the effects of IT maturity on health care organizations' abilities to impact outcomes. It will examine how SMPP have grown through the use of IT and how this has impacted the organization's use of HIT. While previous work has observed some organizational impacts of HIT, they have only studied a single phenomenon that had been impacted and not how the organization as a whole is impacted. While researchers have found that organizations with higher IT maturity tend to show better operational and financial performance, very little prior studies have shown the impact of HIT maturity on SMPP. The dissertation's goal is to answer the following questions:

1. How does HIT usage influence the organizational impacts on Small and Medium Sized Physician Practices?
2. How does the SMPP's HIT maturity influence these impacts?

To answer these questions, the dissertation used a framework derived from DeLone and McLean's (1992, 2003) IS Success Model and the IT Value Hierarchy (Urwiler & Frolick, 2008). The dissertation employed a multiple case study approach by

collecting and analyzing data from various members of five different SMPP. The dissertation found that the process of HIT documentation had a major influence on the SMPP. While it has a positive impact on the patient's Quality of Care, it has a negative impact on Productivity and User Satisfaction. While prior HIT research found that communication was a final outcome of HIT use, this dissertation found that communication is a mitigating factor influencing organizational impacts.

HEALTH INFORMATION TECHNOLOGY (HIT) IN SMALL AND MEDIUM SIZED PHYSICIAN PRACTICES: EXAMINATION OF IMPACTS AND HIT MATURITY

by

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Approved by

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To Michelle, Yarden, and Samuel.

APPROVAL PAGE

This dissertation has been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

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CHAPTER I

INTRODUCTION

1.1 Overview of Dissertation

The dissertation at hand is broken into eight (8) chapters. Chapter 1 provides an overview of the dissertation, the research motivations and research gaps. Chapter 2, describes the theoretical framework that will be used to explore the phenomena. Specifically, it gives an overview of Health Information Technology (HIT), HIT adoption and maturity theories, and the Small and Medium sized Physician Practices (SMPP) that will be studied. Chapter 3 examines the previous work done within HIT impacts. Chapter 4 offers an explanation of multiple case study methodology and how case studies were used in this dissertation. It also provides the criteria for the case selection and the interview protocol for data collection. Finally, this chapter provides an overview of how the data was analyzed. Chapter 5 reports the findings that relate to the first research question. In addition, it provides an updated model based on those findings and future research that can be derived from our findings. Chapter 6 provides the findings related to the second research question. In addition, it provides an updated HIT Value Hierarchy model based on those findings and future research that can be derived from our findings. Chapter 7 provides an overview of the providers' perspective of HIT use in SMPP. Like chapters 5 and 6, it also offers future research that can be derived from our findings.

Chapter 8 gives a synopsis of the findings from the entire dissertation along with the limitations of this dissertation. In addition, this chapter provides the academic and practical implications of this research as well as recommendations to the health industry.

1.2 Research Motivation

As part of the American Recovery and Reinvestment Act (ARRA), the Health Information Technology Economic and Clinical Health (HITECH) Act was created to incentivize the use of Health Information Technology (HIT) programs (Henricks, 2011). Qualified physician offices were offered extra Medicare and Medicaid funds for achieving Meaningful Use measures promulgated by the Centers for Medicare and Medicaid Services (CMS). As of July,2013, $9.5 billion was awarded to Medicare providers and $6 billion was awarded for Medicaid providers (www.cms.gov). Starting in 2015, eligible physicians that do not meet Meaningful Use with certified EHRs will see a one (1) percent reduction in Medicare payments (Henricks, 2011). Until they meet those metrics, payments will be reduced an addition percent each year up to a maximum of five percent although physician advocacy groups (e.g., the American Medical Association (AMA) and the Medical Group Management Association (MGMA)) are trying to delay this timeline (Henricks, 2011). While there have been several studies on HIT adoption and its impact on care quality, there has been little theory driven IS research on HIT use and its impacts on the healthcare sector (Agarwal et al., 2010; Venkatesh et al., 2011).

HITs are a group of systems that allow access to and aids updates of health care information which supports both the clinical and administrative side of a health care

facility (Goldschmidt, 2005; Goldzweig et al., 2009; Menon et al., 2009). Clinical HITs handle patients' records; processes lab results; and provides a means of health information exchange between practices. HITs also handle administrative functions such as scheduling, insurance claims (i.e., Revenue Cycle Management), and inventory management.

While there have been multiple studies on HIT in hospitals and large practices, there have been few studies that have directly examined HITs in Small and Medium sized Physician Practices (SMPP)(Ludwick & Doucette, 2009). SMPP are medical practices that consist of a staff of less than 10 physicians and have historically been the most common place for doctors to work (Decker et al., 2012). These practices can be grouped into two categories, Independent Physician Practices (IPPs) and Affiliated Physician Practices (APPs)(Isaacs et al., 2009; Tollen, 2008; Beasley et al., 2005). IPPs are owned and operated by the attending physicians while APPs are contracted out by a larger medical organization such as a hospital or managed care group. Nearly 60 percent of all US physicians are employed by SMPP (Kane & Emmons, 2013).

Unlike their larger groups and health systems, SMPP have unique challenges with HIT implementation (Reardon & Davidson, 2007). Unless SMPP are subsidized, HIT systems can be too expensive to adopt and implement. SMPP are also ill-equipped to cope with the lost revenue that is incurred during implementation due to reduced productivity (Davidson & Heslinga, 2007). These practices face many challenges to implementing HIT (Casalino et al., 2013; Davidson & Heslinga, 2007 Isaacs et al., 2009;). Despite the pressures of implementing an EHR, SMPPs often lack the economies

of scale or technical support to fully implement the system functionalities required by CMS in the Meaningful Use program (Casalino et al., 2013)(Isaacs et al., 2009).

Researchers have found that organizations with higher IT maturity tend to show better operational and financial performance (Francalanci & Morabito, 2008; Raymond et al., 1995). More recently, Liu et al. (2011) found that hospitals with higher IT maturity have relatively better operational performance. Hospitals with higher IT maturity also are "more efficient and effective, providing higher service quality at lower costs (p. 572)." In their study of 1,011 acute care providers, Dey et al. (2013) found that providers with higher levels of IT maturity show higher operational performance. Collectively, these studies show that we should look at the stages of IT maturity of SMPP to examine how their IT maturity affects their organizational impacts.

1.3 Research Gaps

The research gaps between information systems and HIT maturity within SMPP can be grouped into three categories. First, prior studies have tended to focus on a single variable related to HIT implementation (Ko & Osei-Bryson, 2004; Lichtner et al., 2013). Second, most of those studies have been performed in hospitals and other large medical facilities (Chaudhry et al., 2006; Agarwal et al., 2010). Third, very little research has examined the effects of HIT maturity within medical facilities (Pare & Sicotte, 2001; Dey et al., 2013).

1.3.1 HIT Impacts on Hospitals and Large Medical Facilities

There have been several studies focusing on HIT impacts (Agarwal et al., 2010) such as quality of care (Perez-Cuevas et al., 2012;Nowinski et al., 2007; Byrne et al.,

2010), lower mortality (Jha et al., 2007), chronic disease management (Green et al., 2006), productivity (Eastaugh, 2012), workflow improvement (Lahiri & Seidmann, 2012), coordination (Oborn et al., 2011), costs (Chaudhry et al., 2006), profitability/revenue (Thouin et al., 2008; Kohli & Devaraj, 2004; Bardhan & Thouin, 2013), and organizational culture (Nowinski et al., 2007). These impacts can be grouped into four categories: Care Quality Outcomes, Internal Work Flow, Collaboration and Communication, and Organizational Performance.

The following studies focused on HIT impacts on Care Quality. Nowinski et al. (2007), using a longitudinal study design, examined how an EHR implementation within a large clinical network impacted both care quality and the organization's culture. Kane and Alavi (2008) studied how user interaction with HIT and IS centrality impacted both efficiency of care delivery and care quality. Using secondary data between 2003 and 2007, Byrne et al. (2010) examined the rate of IT adoption and IT spending and their impact on Quality of Care. Perez-Cuevas et al. (2012) more recently examined how four large family practices in Mexico City used EHR systems to measure the care quality for patients with type-2 diabetes. Bardhan and Thouin (2013) studied the impact of Clinical HITs on both care quality and costs.

The next research examined HIT impacts on Internal Work Flow. Ash, et al. (2007) examined the unintended consequences on workflows by implementing CPOEs in hospitals. Aarts et al. (2007) focused their study CPOE impacts on both Quality of Care and Work Flow within large medical facilities. Kane and Labianca (2011) examined EMR implementation's impact on physician IS avoidance and its impact on patient care.

Lahiri and Seidmann (2012) studied Radiology Information Systems (RIS) impact on workflows.

Another set of research focus on HIT's impact on provider collaboration and communication. Beuscart-Zephir, et al. (2005) studied the implementation of CPOE and its impact on care coordination, collaboration, and communication. Oborn et al. (2011) examined EMR usage and its impact on coordination between specialists.

The final set of studies examined HIT impact on performance outcomes. Kohli and Devaraj (2004) studied the impact of Decision Support Systems (DSSs) on healthcare organization revenue. Ko and Osei-Bryson (2004) examined the impact of HIT investment in hospitals to productivity. Thouin et al. (2008) focused their study on financial performance of Integrated Healthcare Delivery Systems (IHDS). Setia et al. (2011) studied how IT was used within hospitals and how it impacted financial performance. Bourgeois et al (2011) examined how IT sophistication impacts financial performance, mortality, and safety. Dey et al. (2013) studied the EMR system capabilities its impact on operational performance. Ward et al. (2014) performed a longitudinal study on the impact of an EHR system on patient satisfaction and efficiency. Lichtner et al. (2013) examined the impact of an Electronic Prescription Service (EPS) on efficiency.

In each of these studies, the researchers only examined one type of impact or a small set of closely-related impacts. This dissertation goes beyond a single impact and studies the overall impact of HIT on an organization.

1.3.2 Small and Medium Sized Physician Practices

SMPP research can be broken into three categories: adoption/implementation studies, impact studies, or some combination thereof (Ford et al., 2006). In this first set of studies, researchers examined HIT adoption and implementation within SMPP. Davidson and Helsinga (2007) used action research to study the EHR adoption in small physician practices in Hawaii. Reardon and Davidson (2007) performed a similar study in Hawaii with the assimilation of EMRs in small physician practices. West, et al. (2004) ran a study on the challenges of implementing an information system in rural physician practices in Scotland. Gans, et al. (2005) ran a survey to study the rates of EHR adoption based on practice sizes. Devine, et al. (2010) studied CPOE implementation. Khan and Western (2011) examined Australian general practitioner's HIT usage. Torda, et al. (2010) examined 29 programs aimed at helping small physician practices adopt and implement of HIT systems and applications. Baron et al. (2005) ran a single case study of the work flow impact from the implementation of the EHRs on their small practice. O'Neill et al. (2011) examined the adoption rate of EMRs in small practices in Kentucky. Lee et al. (2005) reported the results from a panel discussion on HIT adoption in small practices.

The next category covers research that examines HIT impacts on SMPP. Lorenzi et al. (2009) wrote an overview of the benefits of EHRs used in small ambulatory practices. MacDonald and Metzger (2002) ran a multiple case study to observe the benefits of HIT to small physician practices. Metzger and MacDonald (2002) also did a multiple case study on IPPs and the impacts of Clinical Decision Systems (CDSSs).

Bardach et al. (2013) studied the effects of Pay-for-Performance (P4P) on quality of care in small practices that use EHRs. In a single case study, Baron (2007) examined the impact of EHR on the rate of mammography.

Even in the studies that examined HIT impacts within SMPP, they only focused on a single impact and did not examine the overall impact on the organization. This dissertation examines the overall impact of HIT to the organization and how IT maturity influences those impacts.

1.3.3 HIT Maturity

Prior to this dissertation, there has been little research on the effects of IT maturity on HIT systems. Pare and Sicotte (2001) compared IT sophistication in hospitals in two provinces in Canada. Jaana et al. (2005) extended Pare and Sicotte's (2001) study and compared Iowa hospitals with their Canadian counterparts. Venkatesh et al. (2007) examined the Enterprise Architecture Maturity (EAM) of the Veterans Health Administration (VHA). England and Stewart (2007) studied the level of IT adoption of hospitals compared to the banking industry. Liu et al. (2011) examined the e-healthcare maturity in Taiwan hospitals and its impact on financial performance. Dey et al. (2013) studied the EMR system capabilities within 1,011 acute care facilities in the US. While some of these studies (Dey et al., 2013; Jaana et al., 2005;Pare & Sicotte, 2001) have looked at the IT capabilities of healthcare organizations, they did not examine how the organizations have matured through their use of IT. In addition, all of these studies have focused on large organizations such as hospitals and have ignored SMPP.

1.4 Research Questions

The purpose of this dissertation is to explore IT maturity using multiple case study methodology to observe how SMPP have matured through their use of HIT and how that maturity influences HITs impact on these practices. While the work above have observed some organizational impacts of HIT, they have only studied a single phenomenon that had been impacted and not how the organization as a whole has been impacted. Furthermore, these studies have not shown the overall impact of HIT on SMPP. Hence, the goal of this study is to answer the following questions:

1. *How does HIT usage influence the organizational impacts on small and medium sized physician practices? These impacts include:*
    a. *Quality of Care*
    b. *Internal Work Flow*
    c. *Collaboration and Communication*
    d. *Performance Outcomes*
2. *How does the SMPP's HIT maturity influence each of these impacts?*

1.5 Research Approach

To answer those questions, the study is broken into four parts. A thorough literature review was conducted to ascertain the best method to measure the HIT impacts to SMPP. This literature review provides better insights on how SMPP operate and generate relevant interview questions for the data collection phase of the study. The review also provided us with appropriate theories to investigate this phenomenon and

provided a foundation for building the interview instrument. Figure 1 gives a summary of the research approach.

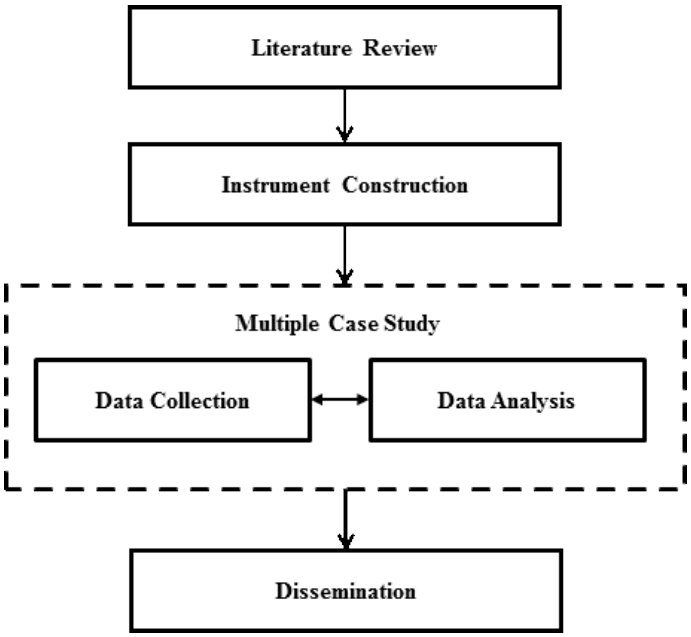

Figure 1. Research Approach

The dissertation used the case study methodology outlined by Yin (2009) for this research. It takes an interpretive approach to this study. The interpretive approach has been demonstrated to give a richer understanding of the phenomenon under study (Klein & Myers, 1999). The dissertation will use the theories described in the following sections to help guide us in the design of our research to gain appropriate insights as we analyze the data (Walsham, 2006). Those theories will provide guidelines on how to categorize the level of IT maturity for each practice. They will also show us how prior studies have examined the various impacts and provide us with tools to evaluate the practices in our study.

Recent studies have shown that case studies provide a deep understanding in the healthcare context that secondary data analysis cannot achieve (Oborn et al., 2011; Goh et al., 2011; Kealy & Stapleton, 2011). Oborn et al. (2011) performed a single case study on an English cancer center and their electronic patient record usage. Goh et al. (2011) ran a single case study of a hospital exploring HIT influences on work routines. Kealy and Stapleton (2011) used multiple cases to study telemedicine projects in conflict areas.

We limited our site selection to those SMPPs that are currently using HIT Systems and that have less than ten (10) physicians working in each practice. We only chose practices that have finished HIT implementation. Data collection will consist of both semi-structured interviews and document analysis. The interviews focused on HIT users which include physicians, physician assistants, nurses, and front office staff. To ensure that all elements of the phenomena being explored were captured, we used Eisenhardt's (1989) rolling assessment approach to case study and perform the analysis phase while collecting data. This will allow us to explore other avenues of inquiry that were not uncovered prior to data collection efforts or published findings. Data collection occurred until data saturation was achieved. Once the data collection and data analysis was finished, the dissertation assessed the framework for its potential utility as an explanatory framework (Yin, 2003).

For this study, we collected data from five (5) SMPP with interviews from providers, clinical support, and administrative support. In addition, we were able to interview four additional providers from four (4) other practices to give us a deeper understanding of the providers' perspectives on HIT use. The researchers then

transcribed interviews. Analysis was started by coding the transcripts based on the constructs from the initial framework drawn from the literature. Once all of the coding was performed, we created matrices that allowed a comparison across roles and practices based on our codes. These techniques lead us to our findings discussed in the latter chapters.

1.6 Findings

This dissertations produced several findings while we strove to answer our two research questions. We found that documentation was both a hindrance and a benefit brought on by HIT. Even though it adds more work for the employees of an SMPP, it has shown to have benefits for patients' Quality of Care. We also found that SMPP do not work in a vacuum and must have contact with other medical providers in order to give their patient's better Quality of Care. HIT has helped SMPP communicate better with these outside providers through electronic means of communication which helps streamline medical data transfers. Finally, we were able to update our original HIT Success Framework to show how Communication and Collaboration have a mediating effect on the different HIT Impacts.

We also found Security had a much larger role in HIT impact than we originally thought. HIT Security provided administrators with the ability to improve Information Quality, Productivity, and Quality of Care. We also found the importance of Inter-Organizational Integration (IOI). With the dependence of SMPP on outside medical providers, lines of easy communication will help both Productivity and Quality of Care as

it becomes easier to get records from hospitals, labs, and specialists. Finally, we created an updated HIT Values Framework with the new IOI Needs level.

Through our interviews with the various providers, we were able to show how the usage of HIT systems influence the organizational impacts on SMPP. We found that while documentation provides plenty of benefits for quality of care, it is detrimental to the productivity of the provider. We were also able to show that HIT does not just start and stop at the door of the SMPP. While it is important to have integration within in the practice, the HIT system must also be able to communicate with all organizations that administer medical care to the patient including the hospitals, labs, and specialists. Finally, we were able to show that improved communications should not be an end goal for the implementation of HIT but a tool to improve the different impacts of the organization.

1.7 Limitations

One limitation with this dissertation is shared with all case studies and that is the small sample size. This can be a problem when analyzing data through statistics but according to Lee (1989), findings can become generalizable through repeated testing. We were able to do this by studying multiple cases and making sure that we had a wide variety in the SMPP that we selected. We studied SMPP that were rural, suburban, and urban. We had four SMPP that were affiliates and one independent SMPP. In addition, we had a variety of SMPP that were at different HIT Maturity levels.

Another limitation is that only SMPPs located in the southeast region of the US were used which limits the generalizability of this dissertation. There may be some

cultural differences between the SMPP that we selected and SMPP in other regions of the US. We are also limited in the case selection to those practices willing to participate. This may limit our selection to those practices that are satisfied with their HIT system. While we did see some informant dissatisfaction, we might have missed SMPP that are struggling to successfully implement HIT.

1.8 IRB Exemption

An application for Institutional Review Board (IRB) Exemption was submitted to the Office of Research Compliance at UNCG and the Office of Research at Cone Health. The application was reviewed by both IRBs. ORC at UNCG exempted the study as it was determined to be "Research or Research-like Activity that does not require IRB Approval. Cone Health's Office of Research expedited the approval at it was determined to pose "no more than minimum risk to human subjects." A copy of the IRB exemptions are included in Appendix A.

CHAPTER II

THEORETICAL FRAMEWORK

In this chapter, an overview is given of Health Information Technology (HIT), HIT adoption, Small and Medium sized Physician Practices (SMPP) and HIT maturity. Those four sections will be followed by the dissertation research framework.

2.1 Overview of HIT

HIT is a group of systems that access and updates health care information which supports both the clinical and administrative side of a health care facility (Goldschmidt, 2005; Goldzweig et al., 2009; Menon et al., 2009). HIT includes applications such as Electronic Health Records (EHR), Electronic Medical Records (EMR), Personal Health Records (PHR), Clinical Decision Support Software (CDSS), Computerized Physician Order Entry (CPOE), and Telemedicine among others (Goldschmidt, 2005; Eastaugh, 2012).

Venkatraman et al. (2008) defined an EMR as an "automated clinical system that generally includes data related to medical history, patient demographics, clinician's notes, drug information, electronic proscriptions and diagnostic test orders" (p. 140). Ideally, EMRs are designed to follow a patient across locations (Williams & Boren, 2008; Dey et al., 2013). In practice, there are no standards with these records as each application is tailored for individual practices and therefore, it is difficult to transfer records between offices with applications from different vendors (Venkatraman et al.,

2008; Hoffman, 2009). In some hospitals, different departments will utilize EMRs from different venders (Venkatraman et al. (2008). Hoffman (2009) wrote that in addition to the issue of standardization that there were other challenges to EMRs. The first is the challenge of adoption. While most physician offices will front the cost of the system, they will not realize the benefits of adoption until later dates which raises a return on investment question. Instead, insurance companies benefit through cost savings such as a reduction in duplicated tests for individual patients. Another challenge to EMRs is complying with the federal Health Insurance Portability and Accountability Act (HIPAA) statues and all of the different state regulations surrounding medical privacy.

An EHR system is software that can support the following capabilities: store and retrieve patient clinical and demographic information; access and update laboratory tests and results; order entry which include pharmaceutical proscriptions; support clinical decisions which include drug interaction (Eastaugh, 2012). Garret and Seidman (2011) argue that the difference between EMRs and EHRs is that EHRs are accessible by all healthcare providers regardless of locale. In the prior literature, EMRs are synonymous with EHRs and defined as capable of distributing electronic records across locations (Williams & Boren, 2008; Dey et al., 2013). PHR is also similar to EMR with the exception that can be accessed and controlled by the patient (Goldschmidt, 2005; Garret and Seidmann).

A CPOE is an application that automates the ordering of medication to ensure legal and safe access to the patient (Kaushal et al., 2003; Ash et al., 2007). Beuscart-Zephir et al. (2005) wrote that CPOEs can include dosage suggestions; reminders about

medication usage; allergy alerts; automated requests to various departments; integration with pharmacies; and, access to lab results. Kaushal et al. (2003) wrote that CPOEs provide a safe and efficient means of giving medical orders as the system is tied electronically with the various labs and pharmacies and does not rely on the legibility of the physician's handwriting. In addition to automating the ordering of medication and tests, most CPOEs have a built in CDSS tool that serves as a safety feature that notifies the physician if there are any known issues with mixing multiple proscriptions (Kaushal et al., 2003; Beuscart-Zephir et al., 2005).

Telemedicine, also known as tele-health, is the practice of medicine from a physician that is not geographically close to their patient (Cho et al., 2009; Cho et al, 2007; Goldschmidt, 2005). Telemedicine can also include the provision of clinical information and medical education (Cho et al., 2009; Cho et al., 2007). This technology is used to provide services to a broader area where healthcare is sparsely provided such as rural areas in the US and third world countries with few physicians (Cho et al., 2009). As a result, healthcare can be provided in a less expensive manner and cover more people than the traditional approach (Cho et al., 2009). Table 1 provides a summary of the different HIT applications.

Table 1. Summary of HIT Applications

HIT Application	Definition
Electronic Health Records	Support the following capabilities: • store and retrieve patient clinical and demographic information • access and update laboratory tests and results • order entry which include pharmaceutical proscriptions • support clinical decisions which include drug • accessible by all healthcare providers regardless of locale
Electronic Medical Records	Application includes data related to medical history, patient demographics, physician notes, drug information, electronic proscriptions and diagnostic test orders.
Personal Health Records	An Electronic Medical Record that can be accessed by the patient.
Computerized Physician Order Entry	Application that automates the ordering of medication to ensure legal and safe access to the patient. It can include: • dosage suggestions • reminders about medication usage • allergy alerts • automated requests to various departments • integration with pharmacies • lab results
Clinical Decision Support Software	A feature of CPOEs that notifies the user if there are any known issues with mixing multiple proscriptions.
Telemedicine	Practice of medicine from a physician that is not geographically close to their patient.

2.2 HIT Adoption

There are two major streams of research in the area of HIT adoption: levels of adoption and the barriers to adoption (Agarwal et al., 2010; Peterson et al., 2011). The first area, levels of HIT adoption, is concerned with the types of organizations that choose to adopt and how fast they are adopting HIT. Jha et al. (2009) found that only 1.5 percent of all US hospitals that responded to their survey had a comprehensive EHR system. In their survey of 2,758 physicians, DesRoches et al. (2008) found that 4 percent of the

physicians had a comprehensive EHR system. McCullough (2008) found that multi-hospital membership and size positively impacts the hospital's adoption rate while competition and type of ownerships has no effect on adoption.

The second area of research, barriers to HIT adoption, can be grouped into four major factors: finance, functionality, user resistance, and environment (Agarwal et al., 2010). Both Jha et al. (2009) and DesRoches et al. (2008) found that financial factors were the largest barrier to adoption. In a survey of 129 physicians, Bhattacherjee and Hikmet (2007) found that physicians' resistance to change had a negative effect on the adoption of a CPOE. Jensen and Aanestad (2007) found in their case study that physicians resisted the newly implemented PHR due to concerns about added work load and perceived additional controls on their work.

2.3 Small and Medium Sized Physician Practices

SMPP are medical practices that consist of a staff of less than 10 physicians (Decker et al., 2012). These practices can be grouped into two categories, Independent Physician Practices (IPPs) and Affiliated Physician Practices (APPs) (Isaacs et al., 2009; Tollen, 2008; Beasley et al., 2005). IPPs are owned and operated by the attending physicians while Affiliated Practices are contracted out by a larger medical organization such as a hospital or managed care group. Nearly 60% of all US physicians are employed by SMPP (Kane & Emmons, 2013).

Unlike their larger counterparts, SMPP have a couple of unique challenges with HIT implementation (Reardon & Davidson, 2007). Unless SMPP are subsidized, HIT systems can be too expensive to implement. SMPP are also ill-equipped to deal with the

lost revenue that is incurred during implementation due to lost productivity (Davidson & Heslinga, 2007). These practices face many challenges to implementing HIT (Casalino et al., 2013; Davidson & Heslinga, 2007Isaacs et al., 2009;). Despite the pressures of implementing an EHR, SMPP lack the scale to fully implement the practices required by CMS (Casalino et al., 2013). Because SMPP are not large enough to negotiate favorable reimbursement rates with health insurers, SMPP lack the income to purchase and implement an HIT (Isaacs et al., 2009).

Prior literature can be broken into two categories: SMPP HIT Adoption and Implementation and HIT Impact on SMPP. The majority of the previous SMPP research has delved into HIT adoption. West et al. (2004) ran a study on the challenges of implementing an information system in rural physician practices in Scotland. Gans, et al. (2005) did a survey to study the rates of EHR adoption based on practice sizes. Lee, et al. (2005) reported the results from a panel discussion on HIT adoption in small practices. Baron, et al. (2005) ran a single case study of the impact of the implementation of the EHRs on their small practice. Davidson and Helsinga (2007) used action research to study the EHR adoption in small physician practices in Hawaii. Reardon and Davidson (2007) performed a similar study in Hawaii with their examination of the assimilation of EMRs in small physician practices.

In more recent studies, Devine, et al. (2010) examined three independent primary care facilities that were implementing CPOE. Torda et al. (2010) examined 29 programs aimed at helping small physician practices adopt and implement of HIT systems and applications. Khan and Western (2011) ran a phone survey of 480 general practitioners

in Australia on their usage of HIT. O'Neill et al. (2011) examined the adoption rate of EMRs in small practices in Kentucky.

The second category of SMPP studies, HIT impacts, was smaller than the first category. MacDonald and Metzger (2002) did a multiple case study to observe the benefits of HIT to small physician practices. Metzger and MacDonald (2002) also did a multiple case study on IPPs and their use of Clinical Decision Systems (CDSSs). In a single case study, Baron (2007) examined the impact of EHR on the rate of mammography. Lorenzi et al. (2009) wrote an overview of EHRs used in small ambulatory practices which they defined as practices with five or less physicians. Bardach et al. (2013) examined the effects of Pay-for-Performance (P4P) on quality of care in small practices that use EHRs. Table 2 summarizes the studies that examine HIT and SMPP as identified in this section.

Table 2. HIT Studies in SMPP

Authors	Research Focus / Methodology	Findings
Davidson & Helsinga (2007)	HIT Adoption / Action Research	Barriers to adoption: • Too costly to install • Integration difficulty both internally and externally
Reardon & Davidson (2007)	HIT Implementation / Survey	Growing practices and practices that already used IT had higher rates of assimilation success
West et al. (2004)	HIT Implementation / Multiple Case Study	• System did not reflect all staff activities. • In rural PCTs, staff took longer to use system and did not reflect role blurring. • System needs customization to properly attend to different PCT needs.
MacDonald & Metzger (2002)	HIT Benefits / Multiple Case Studies	• HIT benefits include more efficiencies, better service, better workflow, increased revenue, and reduced staff. • Small practices require a longer planning period for planning and encounter more disruptions than larger counterparts.
Metzger & MacDonald (2002)	CDSS Usage / Multiple Case Studies	Hardware costs are lowering and popularity of mobile devices is reducing overhead costs.
Gans et al. (2005)	EHR Adoption / Survey	• SMPP were less likely than large practices to have or plan to have EHRs. • Initial reduction on productivity but users believed that their revenues would eventually increase.
Devine et al. (2010)	CPOE Implementation / Focus Group	• Physicians more likely to championed the system if they had remote access to the system and if there were either laptops or PCs in each examination room. • Positive attitudes amongst the users led to more successful implementation. • Implementation was hindered due to unrealistic expectations about the time take to fully implement the CPOE. • Extra time required for entering prescription data challenging to staff.

Authors	Research Focus / Methodology	Findings
Khan & Western (2011)	HIT Adoption / Phone Survey	• 17% of small practices did not use any form of HIT. • Female general practitioners were more likely to use HIT than their male counterparts. • Solo practitioners were less likely to use HIT than other practitioners.
Torda et al. (2010)	HIT Adoption & Implementation / Focus Group	• Due to size and general lack of technical expertise, adoption of HIT for small practices is a challenge. • Implementation phase can lead to the reduction in the number of patients.
Lorenzi et al. (2009)	EHR Benefits and Barriers / Overview	EHRs benefit small practices by • Improve patient care through quick communication between staff and provide quick and easy access to patient records. • Improve office efficiency by reducing the amount of paper work and reduce the time taken to search for relevant information about the patient. • Provide financial gains through the reduction of staff such as records transcribers and can potentially increase the number of patients seen in a day. EHR barriers include: • No set of standards to dictate how records are store. • Steep learning curve and small practices have fewer resources available to provide training opportunities.
Bardach et al. (2013)	EHR Impact / Experimental	The group that was incentivized performed significantly better than the control group in all categories except in cholesterol numbers.
Baron et al. (2005)	EHR Implementation / Single Case Study	• EHR had a negative impact financially as more time was spent interfacing with the system and less patients seen per day. • Due to the disruption of the implementation phase, customer service was negatively impacted during that time period. • Practices had to redesign every workflow in the practice to accommodate the new EHR.

Authors	Research Focus / Methodology	Findings
Baron (2007)	EHR Impact / Single Case Study	• 10% rate increase in the number of mammography performed. • Challenging because not all data in the system was structured.
O'Neill et al. (2011)	EMR Adoption / Survey	• 28% had adopted an EMR. • 14% had fully implemented EMR. • Younger physicians more likely to adopt a system. • EMR adoption was significantly higher in rural areas than their urban practices.
Lee et al. (2005)	HIT Adoption / Panel Discussion	• HIT standardization for small practices is difficult to achieve. • Small practice should customize the application to fit their workflow. • Getting buy-in from all users is essential to successfully implement an HIT system.

By reviewing prior literature on SMPP, we are better informed when designing the interview questions surrounding the organizations themselves. This literature review also gives us better-defined criteria for case selection. This also gives us an opportunity to examine, which impacts have been studied within these practices and help in the selection of the most appropriate impacts for this project. This review has also shown that IT maturity has not been examined in this setting and should be considered when looking at organizational impacts.

2.4 IT Maturity

In this section will be an overview of the various IT maturity models for studying this phenomenon followed by a review of previous IT maturity literature in the healthcare field.

2.4.1 Stage Growth Model

The Stage Growth Model (SGM) was first introduced by Nolan (1979) as a way to describe a firm's maturity with regards to data processing. To score this maturity, Nolan suggested that four criteria should be measured:

1. What is the organization's level of technology spending? As the organization matures, spending increases through the different stages.
2. How sophisticated is the organization's technology? The more mature organizations utilize more automation and rely less on manual data entry.
3. How is the technology used within the organization and does it support the core functions? For example, is a hospital using technology mostly on budgetary processes and very little on the daily operations.
4. How well is the technology being used? For example, is the EMR application just getting used as a data repository or are the users actually making use of the data that is collected?

In the original SGM, there were six stages of growth: initiation, contagion, control, integration, data administration, and maturity. The initiation stage is the entry level for an organization that is just introducing technology. In this stage, basic technology is used to automate the organization's low-level operations. In the next stage, the contagion stage, there is an increase in growth of technology use. Innovation is encouraged through the lessening of management controls as departments are given leeway to which technology is incorporated and how it is used. In the control stage, management starts to show an interest in controlling how technology is used within the

organization. Formalized rules are put into place as to how technology is used in the organization and the organization puts an emphasis on documentation. Systems are starting to be utilized for key functions. In the integration state, the organization observes a benefit to technology use and therefore tries to support its use by assisting end users. Like the contagion stage, there is an increase in technology penetration as more users are encouraged to make use of the new technology. In the data administration stage, upper management starts to implement standardized application across business functions and encourage those departments to share data. This stage emphasizes the integration of different information systems across the entire organization. The final stage, maturity stage, is the "end game" for the organization as technology is streamlined with the business processes. Nolan observed that none of the businesses that he observed had reached that stage and that most organizations were spread across the middle stages.

The SGM has been used and modified by several researchers (Benbasat et al., 1980; England & Stewart, 2003;, 1993; King & Sabherwal, 1992; Lee & Kim, 2001 van Lengen & Morgan). Benbasat et al. (1980) developed an eleven item survey instrument based on Nolan's SGM to measure a firm's maturity. Lee and Kim (2001) modified the SGM to analyze the maturity of a firm's knowledge management (KM). They condensed the number of stages to four in order to tailor the model to KM. Other studies used the SGM to measure the maturity of firms as an independent variable while studying other phenomenon.

2.4.2 Capability Maturity Model

The Capability Maturity Model (CMM) was originally created to classify the maturity of firms that develop software and systems (Paulk, et al., 1993). Paulk, et al. defined immature firms as those that rely on improvised processes for most projects. Those firms focus on immediate issues and do not have processes in place to handle most tasks. They are more concerned with putting on fires than any long-term organizational goal. Projects finished by immature firms tend to be over budget; do not make deadlines; and, are not of the highest quality. Those firms also do not have any internal mechanism for measuring project quality. In stark contrast, mature firms utilize processes that are both adhered to and are effective. Those processes are not stagnate and do get updated when necessary. Roles and responsibilities within the firm are clearly defined. Projects finished by mature firms tend to be on time, within budget, and of high quality. Those firms have known objective criteria for internal quality control.

The CMM focuses on the capability of the firm to develop software products and uses metrics called Key Process Areas (KPAs) (Swinarski et al., 2012). The firms are then rated on how well they reach the goals surrounding the KPAs. Those goals are based on the processes used within those KPAs. For example, are the processes in place effective and are they consistently used? KPAs are broken into four main categories: Engineering, Process Management, Project Management, and Support. Based on how many goals those firms achieve, they are then placed into one of the five CMM levels.

The CMM has been recently used in the IS field for maturity studies. Santos et al. (2011) in a case study of different units within a fire fighting organization measured the

emergency response IS maturity based on a modified CMM. Swinarski et al. (2012) used CMM to compare the IS maturity between small and large firms in the U.S. Farah (2011) developed a framework based on CMM to compare the maturity of risk management within IT. Like the SGM, CMM does a good job of categorizing and describing the maturity of IS within different firms but it does not adequately explain the process of IS maturation.

2.4.3 Strategic Alignment Model

The Strategic Alignment Model (SAM) is based on measuring the alignment between IS processes and business processes (Luftman, 2000 & 2007). Maturity is measured along six types of processes: Communications, Value, Governance, Partnership, Scope and Architecture, and Skills. Based on how well the firm scored on those measures, they are categorized along five levels of maturity ranging from Ad Hoc to Optimized. This model is currently limited to only measure IT alignment and has not been used for any other purpose. Luftman (2007) has used it to study the current state of alignment in the U.S while Chen (2010) has used the same model to study firms in China.

2.4.4 Evolutionary/Contingency Perspectives

The Evolutionary and Contingency Perspective is another view of IS Maturity that has not been widely used but should be noted. The evolutionary view of IS maturity states that only processes and procedures that best fit within an organization will survive over the life of the organization (Teo & King, 1997; van de Ven & Poole, 1995). Unlike the SGM, this form of maturity is not based on pure growth but includes the "pruning" of less useful portions of the organization. Similar to Darwin's theory of evolution, this

perspective stipulates that only best fitting process will survive. Teo and King contend that this perspective still takes a linear view like the SGM and does not allow for alternative routes of maturity. The contingency perspective takes the opposite view and explains that an organization does not have to follow a single path of maturity but can take multiple routes. In addition, some steps can be skipped and through its life, the organization can also go backwards in maturity (Teo & King, 1997).

2.4.5 IT Value Hierarchy

Urwiler and Frolick (2008) took a different approach to studying IT maturity by bringing in psychology. They adapted Maslow's (1954) Hierarchy of Needs theory to the realm of IS. Urwiler and Frolick argue that organizations also have needs and will fulfill them in the order that is required for survival. They ranked IT based on the value to the organization in following order: Infrastructure & Communication Needs, Stability & Security Needs, Integrated Information Needs, Competitive Differentiation, and Paradigm Shifting. The section on the research model (Section 2.5) will provide a more thorough explanation of this theory.

While this theory does a good job in explaining the progress of IT maturity within an organization, it has been little used outside their initial framework. Walsh (2013) used this theory on her grounded theory work on IT culture and needs and how those affect technology acceptance within organizations. She brought in Urwiler and Frolick's theory to explain some of her finding within the study but did not use this as her guiding theoretical framework. This dissertation intends to use Urwiler and Frolick's work as part of our framework to help guide our understanding of IT maturity within SMPP.

2.4.6 HIT Maturity Studies

There have been a few studies that have examined IT Maturity within the healthcare industry. Pare and Sicotte (2001) compared IT sophistication in hospitals in two provinces in Canada. Jaana et al. (2005) used Pare and Sicotte's (2001) instrument in their study of Iowa hospitals. Venkatesh et al. (2007) examined the Enterprise Architecture Maturity (EAM) of the Veterans Health Administration (VHA). England and Stewart (2007) studied the level of IT adoption of hospitals compared to the banking industry. Liu et al. (2011) examined the e-healthcare maturity in Taiwan hospitals and its impact on financial performance. Dey et al. (2013) studied the EMR system capabilities within 1,011 acute care facilities in the US. Table 3 summarizes the studies mentioned above.

Table 3. Summary of HIT Maturity Studies

Authors	Research Focus / Methodology	Findings
Pare and Sicotte (2001)	IT Sophistication / Quantitative Survey	Most hospitals had a moderate to high level of functional sophistication but a low technological sophistication and low integration level
Jaana et al. (2005)	IT Sophistication / Quantitative Survey	• While Canadian hospitals had a higher functional sophistication, Iowa hospitals had a much higher technological sophistication. • For all areas except emergency room functions, Canadian hospitals had a higher integration level than their Iowan counterparts. • In both Canada and Iowa, the percentage of advanced technology use was low.
Venkatesh et al. (2007)	Enterprise Architecture Maturity / Case Study	In their four stages of maturity, the VA has not reached the final stage, Business Modularity Stage
England and Stewart (2007)	Maturity of Use / Quantitative Survey	• The banking sector had a more mature use of IT than hospitals. • The organization's executive vision for IT was a strong indicator for a higher level of maturity.
Liu et al. (2011)	HIT Maturity / Quantitative Survey	• Hospitals with a higher level of IT maturity had lower costs than those with a lower level of IT maturity.
Dey et al. (2013)	IT Capability / Quantitative Secondary Data	Facilities with higher stages of EMR capabilities had a more positive impact on operational performance than facilities with lower EMR capabilities.

While these studies have used IT maturity in the healthcare industry, they have only examined IT maturity within large organizations. In addition, most of these studies only measured the level of IT maturity and either compared the maturity levels between geographic regions or against other industries. Two studies did examine the correlation between IT maturity levels and performance but they only used quantitative analysis to show this correlation. Our study intends to not only show a relationship between IT

maturity and impacts, but we also intend to show how IT maturity influences organizational impacts.

2.5 Research Framework

The framework for this dissertation is based on two theories: DeLone and McLean's (1992, 2003) IS Success Model and Urwiler and Frolick's (2008) IT Value Hierarchy. These two theories will give us a foundation for our study's design. They will help inform us with the design of the interview questions and help us focus our data collection on the constructs that are relevant to HIT impacts and IT maturity. For IT maturity, the IT Value Hierarchy will help categorize the different SMPP in our study in terms of levels of maturity. This will allow us to compare and contrast organizations at varying maturity levels.

The following subsections will provide a summary of both theories that form the basis for the dissertation's framework.

2.5.1 IS Success Model

DeLone and McLean (1992, 2003) introduced an IS Success Model that helps explain the factors that lead to the dependent variable IS Success. In this model, IS Success consists of three interdependent constructs: System Use, User Satisfaction, and Outcomes/Benefits. Shown below is their model (Figure 2).

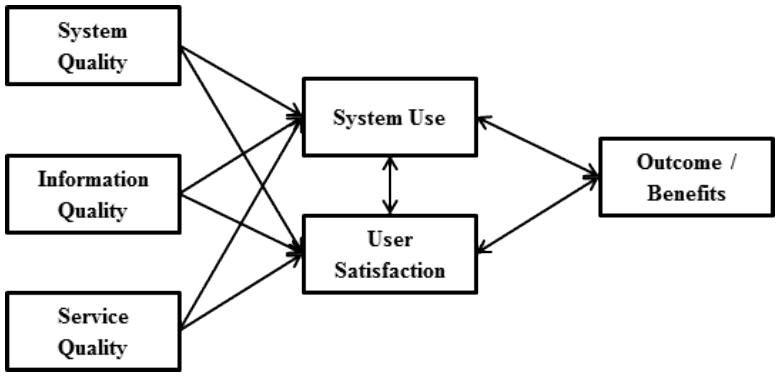

Figure 2. IS Success Model (DeLone & McLean, 2003)

This model includes six constructs: System Quality, Information Quality, Service Quality, System Use, User Satisfaction, and Outcome/Benefits. System Quality is the level of the system's performance. It includes measures such as ease-of-use, integration, functionality, and reliability. Information Quality is quality of the information within the system. Measures for Information Quality include accuracy, timeliness, relevance, and consistency. Service Quality is based on the level of service provided by the IT department or vendor. These measures include user training, system down-time, department reliability, prompt service, and It departmental knowledge. User Satisfaction is the level of satisfaction of the users of the system. When system use is mandatory, the authors argue that this measure has less importance but is still useful (DeLone & McLean, 1992). This may still fit in our study since some practices may find ways to circumvent the system and User Satisfaction may give us some insight into motivation. System Use simply measures how often and to what extent does the user actually interact with the system. Just like User Satisfaction, this measure may be skewed in mandatory use environments. The final construct, Outcome/Benefits, is a measure of all of the

impacts of the system. This includes any user impacts, organizational impacts, and customer impacts. DeLone and McLean intentionally made this construct general because they argue that their model would be overly complicated if each impact is separated.

DeLone and McLean explain that each type of quality will influence both User Satisfaction and System Use which in turn will influence any outcomes or benefits that the system will provide. In addition, through System Use, User Satisfaction will either increase or decline as the users begin to understand the system better. In turn, System Use will be influenced by User Satisfaction as System Use will increase if users are satisfied with the system and decrease if they are not satisfied. Both System Use and User Satisfaction will be influenced by the outcomes and benefits of the system. If the system provides benefits to the organization and users, then users will be more satisfied and use the system more. If the system seems to be detrimental, then User Satisfaction and System Use will decline as users perceive no incentive to its use.

Lau et al. (2012) modified the IS Success model in their literature review of EMR impacts on healthcare organizations. Figure 3 shown below is their modified model. They renamed the Outcome/Benefits construct to Net Benefits and broke that into three sub constructs: Care Quality, Access, and Productivity. To represent Care Quality, they included patient safety, care effectiveness, quality improvement, and guideline compliance. To represent Access, they include communication, patient acceptance, and patient choice. To represent Productivity, they include care efficiency, coordination, and net costs.

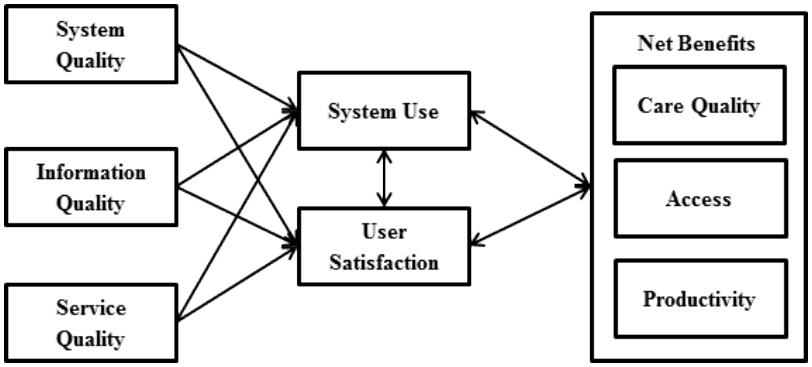

Figure 3. Benefits Evaluation Framework (Lau et al., 2012)

The dissertation will extend Lau et al.'s (2012) framework further by examining Total Impact instead of Net Benefits. This is done to encompass both benefits and costs of the system. Access was dropped from the framework because this study is limited to organizational impacts and not patient impacts. Based on the literature review in Chapter 4, impacts are grouped into four major categories: Quality of Care; Communication & Collaboration; Internal Work Flow; and, Performance Outcomes. The modified framework that is used in this research is shown in Figure 4. The constructs in red are the additions made for this dissertation.

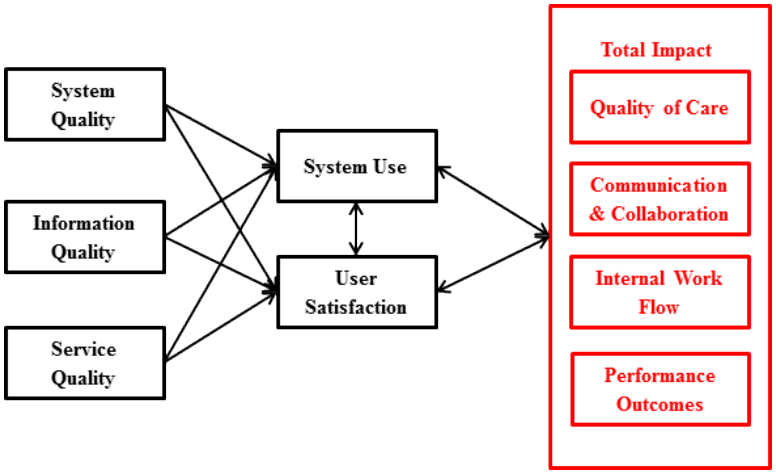

Figure 4. HIT Success Framework to Guide Dissertation Work

2.5.2 IT Value Hierarchy

Maslow's (1954) Theory on Hierarchy of Needs was published in the book, Motivation and Personality. He argued that individuals needed to fulfill their basic needs before they are able to attempt to fulfill any higher level of needs. For example, before a person can think about fulfilling their needs to belong to society (Social Needs), they need to achieve physiological needs (food and air) and safety needs (shelter). Maslow categorized these needs into five levels: Physiological Needs, Safety Needs, Social Needs, Self-Esteem Needs, and Self-Actualization (in Figure 5).

Figure 5. Hierarchy of Needs (Maslow, 1954)

Before attempting any other task, an individual must satisfy their Physiological Needs. This level includes the basic survival requirements such as food, water, and air. Once satisfied with this level, an individual can then formulate a plan to satisfy their Safety Needs. Safety Needs include personal safety and security from the surrounding environment (predators and weather). Next, an individual will attempt to satisfy their Social Needs. Social Needs is the individual's need to belong to a larger group. This group can be a family, tribe, or larger society. Self-Esteem Needs is the individual's need to achieve within their group and to have status within their adopted group. Finally, once the first four levels of needs are satisfied, an individual will attempt to satisfy their highest level of needs, Self-Actualization. This is a very individualized level as it changes based on the person achieving this. This is a state where the individual has

achieved their own goals that they have set. This could range from getting the Nobel Peace prize to finally bowling that perfect 300 point game.

Urwiler and Frolick (2008) created the IT Value Hierarchy that modified Maslow's Hierarchy of Needs to explain IT Maturity for competitive organizations. Like Maslow, they argue that before an organization can strive to achieve the next level of maturity, they must satisfy the lower tiered needs. Their model is shown in Figure 6.

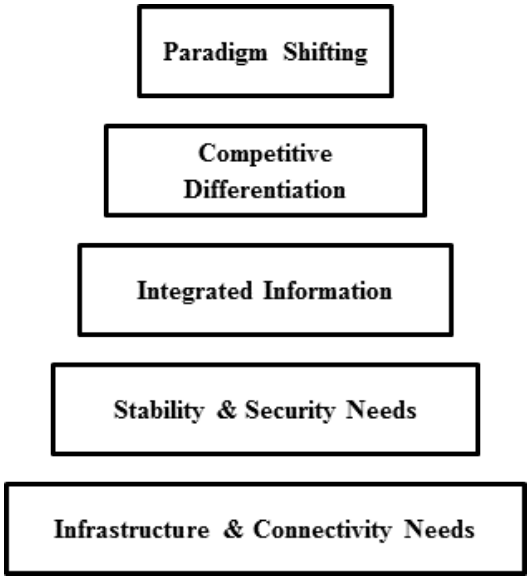

Figure 6. IT Value Hierarchy (Urwiler & Frolick, 2008)

Urwiler and Frolick's model has five IT Maturity levels: Infrastructure & Connectivity Needs; Stability & Security Needs; Integrated Information; Competitive Differentiation; and, Paradigm Shifting. They explain that the first three levels are considered commodity IT and for most organizations, the Integrated Information level is

the highest level that they will achieve. The top two levels are considered innovative IT and are achieved by organizations that see IT as more than a commodity.

The Infrastructure and Connectivity Needs corresponds with Maslow's Physiological Needs. This level is where the organization achieves the basic needs for their organization in order to operate. At this level, organizations are just acquiring basic infrastructure with no standards and little to no IT policies. At this level, their IT department is a reactive group that is there only to install needed equipment and provide fixes when equipment goes down.

The Stability and Security Need corresponds with Maslow's Safety Needs. This level is where organizations realize that IT failure can be detrimental to the organization and so they strive to achieve stability. IT standards and policies begin to form and the organization starts to focus on IT optimization. Security also becomes important at this stage and controlled access to both the system and its information is enacted. IT support becomes more proactive and begins to fix problems before users become aware of them. The organization at this level still has a fragmented IT infrastructure with individual departments with their own equipment and applications and with information staying within the boundaries of each departmental system.

The Integrated Information like Maslow's Social Needs, is the level where departments within the organization have the need to communicate (socialize) outside their departmental boundaries. Information systems begin to cross departmental and functional boundaries and organization wide systems begin to be implemented. Information becomes available across the organization and common business processes

are integrated into the systems. As mentioned earlier, most organizations will not achieve higher levels as they may not see a need to go any further.

The Competitive Differentiation corresponds with Maslow's Self-Esteem Needs where organizations try to show the public why it's unique. At this level, IT takes a greater role in the organization's strategy. Organizations will use unique IT solutions to differentiate themselves from their competitors to try to create a competitive advantage. In its early days, on-line banking was one example where a bank will try to attract new customers through its novel on-line services.

The final level, Paradigm Shifting, like Maslow's Self-Actualization is the pinnacle of the organizations IT maturity. At this level, the organization, through IT, is changing the way industry does business. This is not a case where a new product is created but instead, IT is creating a different way in which the organization is delivering its products and services. One example is Amazon and the selling of books on-line. Another example is Apple's creation of iTunes and the change in the way music was distributed.

Because SMPP do not compete with each other for customers, Urwiler and Frolick's Competitive Differentiation level may not be a good fit with this study. Instead, the level will be changed to Realized Performance Gains. Once the practice has achieved integrated information, they may perform at their normal performance levels and be satisfied with that achievement. Other practices may embrace IT and use it to change their work processes and achieve higher levels of performance through their use of IT. Without data, this is just conjecture and the data will provide more details on how SMPP

progress past the third level if we find that the progress. The modified IT Value Hierarchy is shown below in Figure 7 with the fourth level highlighted in red to show the change from the original Frolick & Urwiler's model.

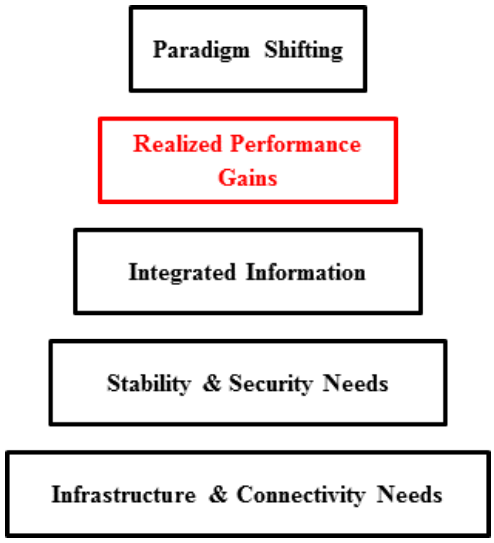

Figure 7. SMPP IT Value Hierarchy Adapted for this Research

As mentioned in the first chapter, studies have found that organizations with higher IT maturity tend to show better performance (Francalanci & Morabito, 2008; Raymond et al., 1995). Unfortunately, those studies do not examine the relationship between IT maturity and organizational outcomes. The purpose of the dissertation is to provide that explanation. Figure 8 provides an overview of our framework for this dissertation. We will collect data for all five of these constructs and through our data collection and analysis, we intent to provide that relationship between IT maturity and organizational impacts.

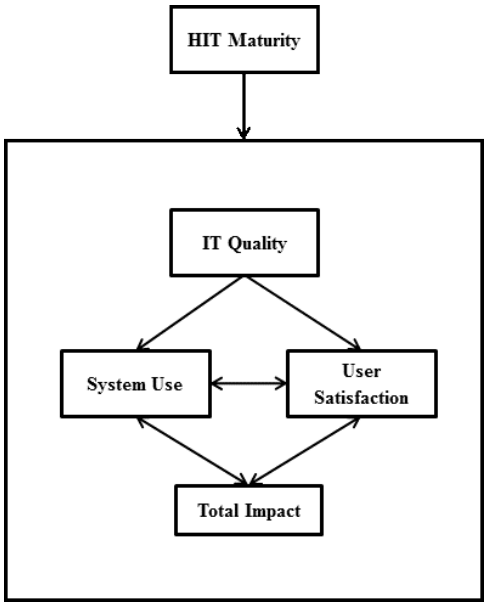

Figure 8. HIT Maturity Impact Framework

CHAPTER III

HIT IMPACTS

In their literature review of HIT impacts, Chaudhry et al. (2006) separated impacts into three categories: Quality, Efficiency, and Costs. In addition to those categories, other studies have examined Collaboration, Communication, and Internal Work Flow. To give a thorough review of HIT impacts we will attempt to be as inclusive as possible and break the impacts into the following categories: Quality of Care, Internal Work Flow, Collaboration and Communication, and Performance Outcomes. The next four sections will give an overview of each impact and how it was studied in prior literature. In the data collection phase of the dissertation, data was collected for all four impacts at each interview to reduce the amount of times that each participant will have to devote for this study.

3.1 Quality of Care

Patient quality of care impacts can be examined in several ways. One indicator is the reduction in errors within an organization (Byrne et al., 2010). HIT systems can help alleviate these errors through decision support tools that warn physicians about drug interaction or allergy issues. Other studies have looked at quality of care through organizational compliance to treatments (Kane & Alavi, 2008; Perez-Cuevas et al., 2012). The final way to measure care quality is through patient satisfaction (Nowinski et

al., 2007). This method is not feasible for this dissertation since the study is focusing on organizational impacts and will not be collecting patient data.

Nowinski et al. (2007) performed a longitudinal study of an EHR implementation within a large clinical network and how the EHR impacted both the organizational culture and the patients' quality of care. Kane and Alavi (2008) were interested in how user interaction with Health Information Systems (HIS) and IS centrality impacted both efficiency of care and quality of care. Using secondary data between 2003 and 2007, Byrne et al. (2010) examined the rate of IT adoption and IT spending and their impact on Quality of Care. Perez-Cuevas et al. (2012) more recently studied four large family practices in Mexico City and how the EHR systems can be used to measure the patients' quality of care. Bardhan and Thouin (2013) studied the impact of Clinical Information Systems (CIS) on both quality of care and costs. Table 4 provides a summary of the findings and methodologies used in these studies.

Table 4. Summary of HIT Quality of Care Studies

Authors	Methodology	Findings
Nowinski et al. (2007)	Quantitative Survey	• Organizations became more hierarchical after system implementation • As work flows and processes were formalized, the organization's hierarchy became more entrenched • Partial evidence of quality of care improvement • Consultation turnaround times had improved
Kane and Alavi (2008)	Social Graph Analysis	• User interaction had no impact on either efficiency of care or quality of care • IS centrality reduced the wait time for patients and had a positive impact on quality of care
Byrne et al. (2010)	Quantitative Secondary Data	• VA hospitals have had a 100% HIT adoption since 2004 vs non-VA hospitals with 61% for EHR adoption, 16% CPOE adoption, and 12% EMR adoption • VA hospitals had higher IT spending and a larger impact on Quality of Care
Perez-Cuevas et al. (2012)	Quantitative Patient Data	• EHR system data could be mined to monitor the quality of care for type 2 diabetes • Using EHR patient data, recommendations could be made for improving treatment in those practices
Bardhan and Thouin (2013)	Quantitative Secondary Data	• Positive correlation between CIS usage and treatment • Greater impact on process quality within not-for-profit and urban hospitals compared to for-profit hospitals • Greater reduction in costs within for-profit hospital compared to the other two categories

3.2 Internal Work Flow

Internal Work Flow is the examination of how members of a health organization perform their duties (Ash et al., 2007). This can involve a transfer of duties from one group of staff to another (Ash et al., 2007; Lichtner et al., 2013). This can also involve

efficiencies within the practice that affect the entire staff (Aarts et al, 2007; Lahiri & Seidmann, 2012). One study examined how physicians took steps to bypass the HIT system completely (Kane & Labianca, 2011). This project will examine all of these aspects of Internal Work Flow and how the HIT and HIT maturity affects it.

Ash et al. (2007) examined the effects of implementing CPOEs in hospitals with regards to workflow, system errors, and organizational culture. Aarts et al. (2007) also focused their efforts on study of CPOEs and its impacts on both quality of care and work flow. Kane and Labianca (2011) studied physicians' avoidance of a newly implemented EMR system in a large medical facility. In a single case study on Radiology Information Systems (RIS), Lahiri and Seidmann (2012) studied the impact on work flows. Lichtner et al. (2013) did a field study on four English General Practitioner (GP) practices and how their use of an Electronic Prescription Service (EPS) impacted employee work load. Table 5 provides a summary of the findings and methodologies used in these studies.

Table 5. Summary of Studies that Examine HIT Internal Work Flow Impacts

Authors	Methodology	Findings

Ash et al. (2007)	Quantitative Survey & Follow-up Qualitative Interviews	• CPOEs impacted hospitals by:
		  ○ creating more and new work
		  ○ changing work flow
		  ○ new system errors
		  ○ creating shifts in power from physicians to staff
		• System slowed work processes when it was taken off line.
		• Many hospital staffs perceived increases in hospital efficiencies
		• Some staff members saw a decrease in work load that was shifted to the physicians

Aarts et al. (2007)	Qualitative Interviews	• CPOEs impacted both quality of care and work flow. • While most organizations did not see improvements, academic medical centers and the VA medical centers did observe some quality of care improvements • Most organizations saw negative impacts on their work flows
Kane and Labianca (2011)	Single Case Study	Patient care is negatively impacted when physician IS avoidance occurs at a bottleneck within the organization's work flow
Lahiri and Seidmann (2012)	Single Case Study	Hang over had a negative effect on the efficiency of care as providers had to take additional time to collect necessary data
Lichtner et al. (2013)	Qualitative Field Study	• Administrative paper work and repeat prescriptions took less time with the implementation of the system • Time was lost due to the slow response of the centralized messaging center. • While staff had less administrative work post implementation, physicians had an increased work load

3.3 Collaboration and Communication

HIT can also impact the way the practice's staff collaborate with one another and how they communicate with outside organizations. The studies summarized below focused on collaboration within the practice (Beuscart-Zephir et al, 2005; Oborn et al., 2011). In addition to that information, we are also interested in exploring how HIT impacts communications outside the practice. This could be as simple as sending prescriptions to a pharmacy or as complex as getting a patient's records from a local hospital. How does the HIT impact those interactions and how can maturity influence that impact?

In a multiple case study, Beuscart-Zephir et al. (2005) the implementation of CPOE in French hospitals and how that implementation impacted the interactions between nurses and doctors. Oborn et al. (2011) performed a single case study on an English cancer center to examine their EMR usage and how it impacted the interaction between doctors of different disciplines. Table 6 provides a summary of the findings and methodologies used in these studies.

Table 6. Summary of HIT Collaboration and Communication Studies

Authors	Methodology	Findings
Beuscart-Zephir et al. (2005)	Multiple Case Studies	With the CPOE implementation: • Little to no collaboration • Errors occurred due to misinterpretation of orders
Oborn et al. (2011)	Single Case Study	Despite unique uses amongst specialists, the system was capable of supporting coordination between individual specialists.

3.4 Performance Outcomes

One group of studies that examined Performance Outcomes focused primarily on financial performance (Kohli & Devaraj, 2004; Ko & Osei-Bryson, 2004; Thouin et al., 2008; Setia et al., 2011). The other group looked at operational performance. Dey et al. (2013) focused on hospital performance with regards to patient throughput. Ward et al. (2014) studied the impact on hospital stays and patient satisfaction. As with the Quality of Care portion of this study, we will not be able to collect patient data for patient satisfaction and patient recovery but we can collect data on the perception of financial performance from the SMPP employees to give us a better understanding of how HIT impacts SMPP performance.

Kohli and Devaraj (2004) studied the revenue impact of Decision Support Systems (DSSs) on healthcare organization revenue. Ko and Osei-Bryson (2004) examined the impact of IT investment on productivity in hospitals. Thouin et al. (2008) focused their study on financial performance of Integrated Healthcare Delivery Systems (IHDS). Setia et al. (2011) examined how IT was used within hospitals and how it impacted financial performance. Bourgeois et al (2011) studied how IT sophistication impacts financial performance, mortality, and safety. Dey et al. (2013) studied the EMR system capabilities impacted operational performance. Ward et al. (2014) performed a longitudinal study on the operational impact of an EHR system on a single Emergency Department (ED) in a suburban, academic medical center. Table 7 provides a summary of the findings and methodologies used in these studies.

Table 7. Summary of HIT Performance Outcome Studies

Authors	Methodology	Findings
Kohli and Devaraj (2004)	Quantitative Historical Data	DSS usage within hospitals had a positive impact on the revenue
Ko and Osei-Bryson (2004)	Quantitative Secondary Data	• IT investments alone do not have a positive impact on hospital productivity • Combined with other investments such as labor and non-IT capital, IT investments show a positive impact on hospital productivity
Thouin et al. (2008)	Quantitative Secondary Data	• Higher levels of HIT spending as well as higher levels of HIT outsourcing had a positive impact on the financial performance of IHDSs • No significant increases of financial performance due to increased levels of HIT staffing.
Setia et al. (2011)	Quantitative Secondary Data	• Only targeted use of business IT had a positive impact on the financial performance • Only wide use of clinical IT had a positive impact. • Long term use of both clinical and business IT had a positive impact.
Bourgeois et al. (2011)	Quantitative Secondary Data	• In small hospitals, IT sophistication only had a significant positive impact on safety. • In medium hospitals, IT sophistication had significant positive impacts on both safety and mortality. • In large hospitals, IT sophistication had a significant negative impact on safety while having a significant positive impact on mortality.
Dey et al. (2013)	Quantitative Secondary Data	Facilities with higher stages of EMR capabilities had a more positive impact on operational performance than facilities with lower EMR capabilities.
Ward et al. (2014)	Longitudinal Case Study	• A temporary increase in hospital stays and a decrease in patient satisfaction after the system were implemented. • Those changes did revert to pre-implementation levels eight weeks after implementation. • Significant increase in tests performed post implementation.

3.5 HIT Impact Summary

The purpose of examining past HIT impact studies is to help inform the researcher on the gaps in the research and to give us a better understanding on which impacts we should focus on in this project. This review has also allowed us to break organizational impacts into the four categories outlined in the previous sections. This will allow us to pursue our data collection in a more organized manner by designing our interview instrument with questions surrounding these impacts. Because the interviews are open ended, we also hope to uncover other impacts that have not been examined in prior research.

3.6 Relationship between HIT Impacts and IT Maturity

Except for a couple of exceptions (Dey et al., 2013; Liu et al., 2011), none of the above studies used IT maturity as an influencing factor with regards to organizational impacts. What the dissertation intends to do is highlight that relationship and provide an explanation for IT maturity's influence on HIT impacts.

This dissertation intends to take a closer look at IT maturity using multiple case study methodology to observe how SMPP have matured through their use of HIT and how that maturity influences HITs impact on these practices. For example, when an organization enters the Stability and Security Needs level, the system will have greater stability and the IT staff (service quality) puts in place IT policy for greater security. As the organization enters the Integrated Information level, the organization can share data more easily and thus increase the data quality within the organization. Over time as the organization matures, the users will use the system more and become more comfortable

and thus more satisfied with the system. Finally, with more IT maturity, the organization will not only have better IT capabilities but the users will be more experienced and more efficient in its use and that will influence the organizational impacts.

CHAPTER IV

METHODOLOGY

The following chapter will give a brief description of case study, describe the criteria for the SMPP that we are targeting for this project, and the protocols that we will use for each case.

4.1 Case Study

We will use the case study methodology outlined by Yin (2009) for this research. We will take an interpretive approach to this study, and unlike the positivist approach, we will not have any pre-determined dependent and independent variables. Instead, we will search for a richer understanding of the phenomenon under study (Klein & Myers, 1999). We will use the theories described in the following sections to help guide us in design the research to gain appropriate insights as we analyze the data (Walsham, 2006).

Case study is "an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context" (Yin, 2003, p. 18). Case study is an excellent method to both test and generate theory (Eisenhardt, 1989). Case study excels at answering explanatory research questions (Yin, 2009). Because there is still a lot of work to be done in this research area, this methodology is a better approach to explore this phenomenon and will give us a better understanding of the relationships between the framework's constructs. In our study, we are trying to explain how IT Maturity affects

HIT impacts on SMPP and by collecting qualitative data from multiple sources; we will get a deeper understanding of this phenomenon.

Prior studies have shown that case studies provide a deep understanding in both the SMPP context and in HIT. West et al. (2004) performed a case study on the challenges of implementing an information system in rural physician practices in Scotland. MacDonald and Metzer (2002) used multiple case study to observe the benefits of HIT to small physician practices. Baron et al. (2005) ran a single case study of the impact of the implementation of the EHRs on their small practice. Ward et al. (2014) used case study to understand the EHR impact on a hospital's performance. Lichtner et al. (2013) also used this method to understand the impact of e-prescribing systems on office efficiencies. Lahiri and Seidmann (2012) used case study methodology to understand the impact of Radiology Information Systems (RIS) on an office's workflow.

4.2 Site and Interview Protocol

The following is the proposed protocol for gathering data from each site:

1. Once a practice has been identified as a possible case study and site approval has been given, a single point of contact will initiated (either an office manager or head physician).
2. From that contact, participants will be identified based on willingness and the current roles within the practice.
3. Once the subject as consented, an interview will be scheduled based on the subject's availability. At this time, a location that is both convenient and private

will be agreed upon. Also, the subject will be asked if audio recording the interview is permissible.

4. At the beginning of the interview, the subject will be asked again if it is permissible to use an audio recording device.
5. The researcher will then ask semi structured questions based on the subject's use of health information technology and how they perceive its impact on the organization.
6. Once the interview has been concluded, the subject will be asked if they can be contacted later for some follow-up questions and the best way to contact them.

Given that qualitative studies demand time commitment of the participating organizations, we anticipated our request for research participation would result in smaller response rate as most small practices have heavy demands on their time as they are not heavily staffed. The anticipate length of these semi-structured interviews will be 60 minutes per interview.

4.3 Interview Questions

The interview instrument (in Appendix B) was derived from prior studies. To further validate this instrument, it was reviewed by a senior faculty member familiar with the healthcare domain. In addition, we were able to interview and get feedback from the Chief Medical Information Officer at the local hospital.

The instrument is divided into two parts. The first part of the instrument is a series of open ended questions that promote the subject to give a full response. These questions were derived from literature and the sources are documented in Table 8 below.

This will give us a more data on the subject and may lead us to further questions during the interview and help expand the number and type of questions for future interviews. This section will be utilized for all interviews with SMPP personnel.

The second part of the instrument is a series of yes/no questions that will be given only once per case. These questions were derived from the CMS's Stage 1 Meaningful Use criteria (www.cms.gov; Albert et al., 2011). This will be answered by a single provider from each SMPP. The purpose of these questions is to gauge the Meaningful Use stage the practice is currently at.

Table 8. Sources of Interview Questions.

Question Category	Source
Maturity	Frolick & Urwiler, 2008
HIT Quality	DeLone & McLean, 1992 & 2003
HIT Use	
User Satisfaction	
Quality of Care	Aarts et al., 2007; Kaushal et al., 2003
Internal Work Flow	Ash et al., 2007; Aarts et al., 2007; Lichtner et al., 2013
User Communication & Collaboration	Beuscart-Zephir et al., 2005; Oborn et al., 2011
Performance Outcomes	Kohli & Devaraj, 2004; Ko & Osei-Bryson, 2004; Thouin et al., 2008; Ward et al., 2014

4.4 Site Selection and Case Summary

We intend to study several SMPP in order to answer our research questions. SMPP will be selected based on size and willingness to participate. We are targeting physician practices in Guildford County and the surrounding counties that employ 10 or less physicians with most practices with 5 or 6 physicians. We will only select practices

that have been using an HIT system for at least one year. Before we conduct any interviews, we will get site approval from the practice and subject approval from each participant.

The dissertation used only interview subjects that are employed by the physician practices. We received a wide selection of roles within each practice by interviewing physicians, physician assistants, nurses, medical assistants, and front office staff. **We did NOT interview patients.** Our study is only interested in the organization and how the organization is impacted by their information system.

Each affiliated practice was associated with a different parent organization. The practices were located in central North Carolina spread out between Charlotte, Greensboro, Durham, and the surrounding areas. Also note that Practice B and Practice E both use the same HIT system.

4.5 Analysis Technique

To analyze the data, we used the coding techniques proposed by Miles and Huberman (1994). Instead of trying to analyze pages of transcripts, this technique enables us to categorize chunks of the quotes into manageable pieces that can be compared and contrasted across subjects. This technique has been successfully used in other IS interpretive research (Robey et al., 2002; Spears & Barki, 2010). Using initial codes based on our theoretical framework, the transcriptions were analyzed using Atlas.ti version 7. Once the coding was finished, the codes were separated out and grouped by those constructs. For example, all codes based on operational performance such as productivity and patient satisfaction were put into a single file. Those quotes were then

summarized and put into a matrix where the providers' quotes could be compared with one another and analyzed. Table 10 is an abbreviated example of one matrix that was used to analyze Communications for Practice E. The following three chapters summarize the findings from this analysis.

Table 9. Case Summary

Case	# of Providers	Size	# of Subjects	Location	IPP	HIT System	Experience
A	5	13	4	Rural		Allscripts	2 years
B	6	27	3	Suburban		Epic	2.5 years
C	7	60	3	Urban		Canopy	6 years
D	8	24	1	Urban	Yes	Greenway	3.5 years
E	6	13	4	Suburban		Epic	2 years
F	3	10	1	Suburban		Epic	2 months
G	8	33	1	Rural		Allscripts	4 years
H	10	34	1	Urban		Epic	2 years
I	3	5	3	Urban	Yes	eClinical Works	10 years

Table 10. Communication Matrix for Practice E

Participants	Communication
Physician	• Use messaging to assign tasks to staff • With system, work flow has changed and has promoted more face-to-face communication • Some pharmacies with both fax and e-prescribe will fail to check the electronic system and fill prescriptions late. • Patients use patient portal to access their medical information and to message the practice
Nurse Practitioner	• Interact with patients through patient portal • Patient portal is "really convenient" and "takes a lot less time than playing phone tag" • Labs are released to patient through portal • Use messaging to assign tasks • "Sometimes it's easier to talk to somebody about it than to send a message"
Nurse	• Patient portal provides an electronic way to communicate with the practice about questions and refills • Phone calls are documented in the system and those messages are forwarded to the provider • All lab requests and results are sent through system • Patients can communicate with practice through patient portal • Messages coming from front desk are sent electronically back to the clinical side • When patients are admitted to associated hospital, office gets notified electronically • Patients able to send electronic requests for refills
Office 1E	• Patient portal provides a channel for the patient to contact the practice and review their medical information • Most communication between co-workers is done electronically • When patients are discharged from hospital, practice will contact patient for a follow up • Gets billing questions through patient portal • Patients like the electronic access to their provider • Lab results sent through portal • System helps with patient outreach • Patient after visit summaries can now be sent electronically through the portal if they've signed up

4.6 Validation

According to Lin (2009), there are several tests to ensure that a case study has validity. Validity can be broken down into four categories: construct validity, internal validity, external validity, and reliability. Construct validity is the identification of the "correct operational measures for the concepts being studied" (Lin, 2009, p. 40). There are a couple of tests to ensure construct validity. First, a research can collect data from multiple sources and in this study, we interviewed multiple people in each case. Second, to create a strong chain of evidence. This is the act of presenting cited sources for the different findings that a researcher makes. This allows the reader to examine the researcher's conclusion and be able to work backwards and piece the same evidence that the researcher has presented and derive the same conclusions. In the next few chapters, we have presented our findings alongside example quotes from this study's participants.

Internal validity is the concern that the relationships found in the study are well-founded. This can be achieved during the data analysis phase. By having multiple researchers check the coding of the transcripts, bias of a single researcher can be mitigated. This was done throughout the coding phase of the dissertation. In addition, matrices were also cross examined by multiple researchers to ensure consensus amongst the researchers.

External validity is concerned with the generalizability of the study. This can be achieved through the use of multiple cases. In our study, we were able to achieve data saturation as we were seeing the same results across multiple SMPP. This assures that our findings are at least generalizable for SMPP in this region of the US.

Finally, reliability is the ability of another researcher to replicate the results of this study. Throughout this dissertation, we have documented our procedures and our tools of analysis so that another researcher can easily take this study and replicate it for other SMPP. In addition, we have kept a database (through Atlas.ti version 7) of all of the data used in this dissertation along with the coding results.

CHAPTER V

SMPP HIT USE AND ORGANIZATIONAL IMPACTS

5.1 Summary of Research Question 1

As mentioned in the Introduction, the goal of this dissertation is to answer two research questions. In this section, we will focus on the first research question: *How does HIT usage influence the organizational impacts on small and medium sized physician practices?* Using the HIT Success framework from Chapter 2, we will break the findings along the following categories: HIT Quality, HIT Use, User Satisfaction, Communication/Collaboration, and HIT Impacts. We will then discuss the themes found in this study and present an updated framework based on our findings. We will then discuss future directions for the first research question and summarize this chapter.

5.2 Findings

In the interview, we were able to touch on multiple topics concerning their use of HIT, its impact, and how the practice has matured in its IT use. The following subsections will summarize those findings for each construct in our framework.

5.2.1 HIT Quality

HIT Quality has had some influence on SMPP and this sub-section will break that influence into the three sub categories of HIT Quality: Information Quality, Service Quality, and System Quality. First, Information Quality was rated fairly high in each of the practices with reliable and accurate emerging as common descriptors. A few

informants discussed how the information quality was dependent on the person entering the data.

> It depends on the person putting the information into the computer … it means the system as a whole is great, the user has to put in the information appropriately. (Nurse Practitioner, Practice E)

Most of the informants also felt that the information was well formatted and organized. They also believed that the information was accessible and it was easy to search for specific information within a patient's chart. The one exception to this accessibility is the lack of easy searches within scanned documents. None of the systems in the practices that we investigated had the ability to do a search within scanned documents which left the user to scan those documents manually in order to get specific information out of them.

One other complaint came from practices A and E and that was the sheer amount of information presented by the system. Specifically, providers felt that the drug interaction alerts were too many and could lead to providers ignoring alerts that may be important because they were already aware of a majority of those alerts. When asked if there was a problem with too many pop-up alerts when ordering a prescription, Physician 1 from Practice E responded:

> Some of them are a bit over the top, yeah especially someone who has a food allergy that's a questionable food allergy and it can pop into all these interactions with all these drugs and you go really and so again I think sometimes, yes. (Physician 1, Practice E)

The second category of HIT Quality includes the sub category of Service Quality. We broke this category into two groups: HIT system training and IT support. Starting with HIT system training, all four affiliated practices received some form of training prior to system rollout.

Practice B and E adopters of the same HIT system also had some employees receive extra training and classified them as super users. Super users would leverage their extra training and understand of the system to assist other users in their practice to learn the system. This helps alleviate the need for IT support when users had questions. Super users in practice B also had continuing education with regards to the system so they can disseminate the new information to the rest of the practice. When the Administrative Worker in Practice E asked about how the informant, as super user, disseminated the information from continuing education:

> So whether it's through email or in service it or like email communication in service to just, 'oh hey I also learned this.' Presenting updates through meetings and things like that (Office 1, Practice E)

One big complaint heard from a few informants was that the training prior to the system rollout was not very realistic and lacked "real world" examples that users would actually encounter. They felt that it would be more useful to see how the system can be used with problems that they would normally encounter. This bore out with the Medical Assistant from Practice E that had started with the practice after system rollout and had worked with the system a few days prior to receiving formal training. That informant felt that the training was more meaningful since they had a chance to use the system and

become familiar with some of the interface before going to a formal classroom environment.

> I felt like I had a better understanding of it because I had actually done it, as opposed to having no idea how it was going to work in a real patient setting and learning about it and try to apply it. I already got to apply it and kind of see how it works so, I don't know, class was OK but I felt like learning on the job was a lot easier (Medical Assistant, Practice E)

Another complaint was that some users felt that they did not receive enough training prior to system rollout. This was especially evident in practices B and E where most of the users did not receive super user training and thus took longer to become familiar with the system. The provider from Practice C complained that they were not paid for the time spent in training and they may have prevented them from going to more trainings. Practice I, the only independent practice in the study, was an exception to this phenomenon. All three informants started at the practice after system implementation and they did not receive formal training. According to each of them, they were responsible for learning the system on their own. In each instance, they felt that the system was easy to learn and had no problems becoming familiar with it.

Overall, the IT support was rated high and most informants commented that they received quick responses from their vendor's IT support. This held true for any major issues such as system shutdowns but in some practices the support responds slower for minor issues. For practice I, it took 2 weeks to fix the electronic fax feature of their HIT system.

After system upgrades or updates, two informants complained that the vendor did not give adequate documentation about the system changes. This caused some productivity loss as the practice had to become familiar with the new changes. Provider from practice C had issues with a lack of IT support on site and complained that they had little to no time to interact with their HIT's support. A couple of informants from practice I had trouble interacting with their offshore IT support, complaining about the language barrier and understanding the support personnel. To mitigate some productivity loss with interacting with the vendor IT support, practice A has an employee designated as the liaison with the IT so all requests go through them and they are the only ones taking time to contact the support.

The third and final category of HIT Quality is System Quality. Most of the practices had intermittent HIT system outages ranging from once every two weeks to twice a year. These outages could range from 5 minutes to half a day depending on the practice. This lead to decreases in productivity as personnel had to resort to paper backups which cost them extra work when the system came back as they had to enter or scan the information back into the system. This also caused some problems with Quality of Care as patient history was not available during these shutdowns which limited the amount of information available to the provider. Most of the employees of practice E never experience a complete shutdown but had experienced some intermittent slowdowns which did not affect their productivity.

Another issue found in System Quality is the usability of the system. Many informants complained about the system requiring too many clicks or the system not

being “user friendly”. The office manager from practice B discussed that they have been able to memorize all the common areas that they interact with to make their work easier but still takes them time to navigate the system when they have to do a task that they are not familiar with. Another informant, Physician 1 from practice A said that they were a “monkey see, monkey do” user. These instances suggest that the systems are not very intuitive and are hard to work with if the user is first using it.

> I feel like it could be laid out better and when you’re using it you have to do a lot of clicking, unnecessary clicking to get to something so I just feel like it could be laid out better (Office Manager, Practice I)

Two informants, the Medical Assistant from Practice E and the Provider from practice I felt that the system was user friendly and was satisfied with the system. For practice E, they employ the use of templates which gives them some customization and allows them to tailor the system to their workflow.

5.2.2 HIT Use and User Satisfaction

In this section, we will discuss the HIT system use and the user satisfaction within these cases. Table 11 below summarizes the subjects’ experience with HIT in general and their experience with their current system. Included is the practice, their experience with HIT, and their experience with their current HIT system.

Table 11. Summary of Participants

User	Practice	Experience with HIT (in years)	Experience with current HIT
Physician 1	A	8	2 years
Physician 2	A	7.5	2 years
Medical Assistant 1	A	5	2 years
Office 1	A	8	2 years
Physician 3	B	7	2.5 years
Nurse 1	B	7.5	2.5 years
Office 2	B	10	2.5 year
Physician 4	C	6	6 years
Nurse 2	C	3	3 years
Office 3	C	6	6 years
Physician 5	E	7	2 years
Nurse Practitioner 1	E	3	10 months
Medical Assistant 2	E	4	2 years
Office 4	E	8	2 years
Physician 6	I	16	7 years
Nurse 3	I	12	9.5 years
Office 5	I	7	7 years

Through case selection, all users and practices in this study are currently using HIT and all workers in these practices are required to use the system in their everyday workflow. In all of the practices, except for practice C, they are only using a single, fully integrated system. Practice C is working with three different systems (EMR, registration, and scheduling) with limited integration. In all of the affiliated cases, they all have to use the NC Immunization Registry (NCIR) and their HIT system is not integrated with it. When immunizations are given, the user has to enter the same data twice, once for the

HIT system and once for the NCIR. Practice I does not have to deal with the NCIR since they do not take Medicare or Medicaid and have very little pediatric patients.

In every case in this study, the practice has to use paper for some tasks. When dealing with labs, specialists, hospitals, and other health providers from outside their parent health system, they have to send patient information and receive patient information outside of the HIT system. Paper is also used for consent forms, forms for patients' employers, surveys, and sports physicals. In some cases, pharmacies do not accept electronic prescriptions. In these cases, the information is either delivered by the patient or faxed. In either case, the practice has to scan the notes into the system and manually attach it to the patient's chart. For system outages, paper is used as a backup and then the information is either entered manually or scanned in when the system comes back. For the affiliated practices, after visit summaries are printed for patient in order to comply with meaningful use.

One of the areas where we collected less data was in User Satisfaction. On a scale of 1 to 5, user satisfaction ranged from 3 to 5 (the highest) with most users rating it between 4 and 5. Most users are frustrated with the intermittent outages and the extra work that it involves. Practice I was frustrated with the remote support that they receive. And most providers were frustrated with the extra work that is required for documentation. Despite these frustrations, some of the users like the system because of the benefits to Quality of Care and other increases to productivity such as easy reporting and electronic prescription refills.

> Probably the best thing from the very beginning has been the electronic medication ordering. That's the best part that has revolutionized what we do. A lot of times we wrote prescriptions before being on the computer, the handwriting is unintelligible, the dosage could be wrong … when you type it in its easier figuring out the prescription so you know it's just going to be correct when you type it in, you have some confidence. (Physician, Practice B)

5.2.3 Communication and Collaboration

HIT influenced Communication in several ways. Patient portals provided patients with access to providers. It allows them to communicate with their provider without having to synchronizing their times. It gave patients easy access to their lab results, medical history, and after visit summaries. It also provided patients with another way to request refills, schedule appointments, and ask questions about billing. Finally, the portal gave the practices another way to contact patients about overdue vaccines, tests, and prescriptions. Practice C was the only practice in the study that did not rely on patient portals. While they do have it, their physician has never used it and not many of the patients are using according to the other informants. This may be a result of the demographics of the patients as they are in the lower economic scale and may not have easy access to computers and the internet.

With electronic prescriptions, practices can be sure that the prescriptions gets to the pharmacy and provides a way to verify if it was filled properly. Electronic prescriptions also provide some forms of safety as it cuts down on handwriting errors.

In addition, the system provides another channel for providers to contact specialists about patients' health. Users no longer have to rely on coordinating times to

make a phone call as each user can send and respond to messages as their time is freed up.

Users can also assign tasks to their coworkers without having to rely on written requests which in the past, can be lost and forgotten. These electronic messages are documented in the system for later review if something is missed. Also, messages concerning particular patients are attached to that patient's chart for easy tracking. When patients call the practice, the front office has easy access to that patient's chart and can quickly answer questions or address complaints without having to contact the clinical side of the practice.

One disadvantage that HIT brings to practices is added work involved when communication cannot be done through the system. When paper is received outside the HIT system, it has to be scanned and faxed and in some cases, approved by the provider before that information is put into the patient's chart. This adds extra work to the front office and can add extra time before that documentation is added to a patient's record. To help mitigate that, Practice I relies on electronic faxes for their out of practice communications. Instead of a traditional fax, the electronic fax comes directly into the system and can be routed to the proper patient record without the use of printing and scanning.

The only evidence of collaboration that can be found in this study is in the use of HIT system to consult with specialists that reside within the same parent organization. Some providers discussed how the system makes it easier to contact the specialists. For some providers, it made it easy to work with the patients in their practice that see other

providers. By having access to records to all patients in the practice, providers can see the other patients since all of the patient's history is available within the system. Physician 1 from Practice C recounted a story about collaboration:

> So I was on call one Friday afternoon and I was about to leave the office, it was closed at 6 and I was like finishing up and I get this pop-up message that a patient of mine was, was being discharged from the emergency room. So I went and looked at the emergency room records … and look and this patient of mine was in the emergency room. He has a very bad lung disease, he was a former smoker, he's on oxygen, then he went to the emergency room with a cough or something. They did a CT and he had a lung mass and probable cancer and they send him out and so I ask him and they made him an appointment for the following week and I'm like great, they just told this guy who probably has lung cancer, came out of the emergency room [and] he's not going to see anybody for a week and then what am I supposed to do? This guy who's on oxygen, he has a lung doctor and I call him up and make sure that he's OK but then I messaged his lung doctor and prayed that he wasn't out of town, you know out of town and he picked up the message and he scheduled him for the next step [and] set him up before I even saw him in a week. (Physician, Practice C)

5.2.4 HIT Impacts

This subsection will break HIT impacts into four categories: Financial Performance, Internal Workflow, Operational Performance, and Quality of Care. First, we will discuss the Financial Performance of the SMPP and how HIT influences it. Three of the practices (A, B, and E) discussed how the system helps them collect more charges. The system will prompt the user if there is a charge that is missed based on the tests and treatments ordered. This prevents the office from missing any billing opportunities to either the patient or the third party payer. Two of the practices

mentioned that the HIT system made it easier to make charges by allowing the front office to bill based the data collected in the patient's chart.

Most of the practices mentioned that the system helps ensure timely payments when bills are sent out. Practice I's system error checks billing before it goes out to ensure that all of the information is there and is not rejected. This ensures that there is no "bouncing" of payments that requires back and forth correspondence between the practice and the payer.

Finally, two of the SMPP (A and B) discussed how the system gives them an opportunity to collect bonus money from outside entities because of their use of HIT. Practice A can use the system to show how they are improving patient quality through reporting and the main insurance company in the area gives them bonuses for those results. Practice B receives extra revenue from CMS for meeting meaningful use metrics.

Another financial benefit is the savings in labor requirements. The Nurse from Practice I observed:

> We don't need a medical records person, we don't need two front office people, we don't need a collection person, we don't need a billing person, you know all these extra people because it's so consolidated that you can do your own billing so, yes, it is a cost saving as far as overhead. (Nurse, Practice I)

HIT has also influenced the way SMPP enact their Internal Workflow. Practice E uses templates to customize their EMR in such a way to have the system drive the workflow of the exam. In addition, nurses and medical assistants are now front loading some of the data entry such as vitals and problem complaints. This frees up some of the

work that the providers have done in the past and makes that data available to the provider as soon as the chart is updated.

Unfortunately, these practices are only helping provider a little bit because they still have more documentation requirements with the introduction of HIT. In some cases, providers are putting in more hours to finish their documentation outside of their usual office hours. In addition, because some documents come into the SMPP as paper or fax and must be scanned in, some providers are required to review those scanned documents and approve them before they are attached to the patient's record.

As mentioned in Chapter 3, operational performance can be broken down in to two categories: Patient Satisfaction and Productivity. Because we limited our case study to collecting data from just the employees of the SMPP, we only got their perception of patient satisfaction and not a direct measurement of patient satisfaction. All of the practice's administrative informants discussed how the system makes it easy to field complaints and answer questions for patients. This prevents patients from having to stay on the phone while administrators search for their answers. Two of the practices (A and E) mentioned that patients in general were happy with portal. In some cases, patients have complained about the attention that the providers pay to the system and not them.

> Patients complain "They come in with their computers and they're not giving me that face-to-face or they're trying to learn their computers putting stuff in," I've heard that when we first went on. (Office Manager, Practice A)

The second category of Operational Performance is Productivity. With the changes to the Internal Workflow, more work has been added to all of the roles in the SMPP. Everyone is required to document more information in the patients' charts. When there is an outage, more work is required to enter the data into the system once the system is recovered. Informants discussed that improved typing skills, the use of keyboard shortcuts, and use of templates have helped mitigate the extra work caused by documentation. In addition, follow up examinations require less work since some of the documentation can reused from the past visit. It also takes less time to complete electronic prescription refill orders. Practice E discussed how faxed prescriptions can take longer as it takes more steps and labor to fill.

Temporary hits to productivity were caused at the beginning during system implementation as personnel worked to become familiar with the system and took longer to do tasks on the new system. In addition, administrative personnel were required to transition older records to the new systems. To help offset patient dissatisfaction with lower productivity, most of the SMPP reduced the number of patients examined in a day during the implementation phase. Unfortunately, none of the informants from Practice I were around during implementation so I do not have any data from the independent practice. As mentioned earlier, because NCIR is not integrated with these systems, extra work is required to enter the immunization data twice.

Because some documents do not enter the practice through the HIT system, it takes longer to process. Faxed or paper copies have to be scanned and put into the system. More work is added to providers that have to approve those scans before they

are attached to a record. Information requested from hospitals outside the parent organization may take longer to process and sent to SMPP. Physician 1 from practice C mentioned that it took two weeks to get information from one hospital in the same city.

Informants did discuss that information was easy and quick to retrieve unless they were looking for data within a scanned document. Scanned documents may take longer if the system cannot search the document and it may even take longer to find scanned documents if they are mislabeled.

Administrative personnel discussed how the system helps their productivity. It takes less time to generate reports since the system can collect the needed data and display that data into a usable format. In terms of communication, informants discussed how it takes less time to document and forward phone messages to the correct recipient. Streamlined communication within the practice has also helped with productivity as mentioned by Practice B's office manager:

> I would say it's faster in a lot ways and we're looking at as a group as a health system to figure out ways to improve staff running around as much which exercise is good but if you have people running around like a chicken with their head cut off you're not getting as much done (Office Manager, Practice B)

The last category of HIT impacts that we will discuss is Quality of Care. Quality of Care in improved through safety. The system will alert users if there are any problems with drug interactions or allergies. In addition, prescriptions and orders no longer have handwriting mistakes due to illegibility. For some systems, the user will be given dosage recommendations. Physician 1 in practice E discussed how the system will recommend

additional tests for certain diagnosis. In two of the practices (C and E), the SMPP are informed when their patients are discharged which allows the SMPP to contact the patient for follow up exams. Messages can be used clarify orders within the practice. With electronic records, charts can no longer be misplaced. Practice E tracks patients with fall risks and have protocols in place to mitigate the risks to their patients.

Better documentation within the HIT system has also improved Quality of Care. More detailed information is getting captured. Messages between personnel and between practice and patient are now documented and attached to patients' charts to give the providers more information about the patient's health and their treatment. In addition to the collection of data, the system providers better access to that data once it is in the system. Both providers and patients have easy access to various portions of the patient's record. This includes health maintenance sections to alert for overdue treatments and tests. It also includes the patient's medication list so it is easier to refill medication. Past medical history and treatments makes the provider better informed about what was prescribed in the past and what worked and provide more information about their health trends. Some informants discussed how their patients found errors in their own charts in which the practice was able to correct. Some providers commented that access outside of the office helped them answer patient requests when they were on call. The patient portal gives patients another channel to access their providers. Practices B and E (same HIT system) has a feature in the system that is a knowledge repository that can be used as a reference for ailments and treatments. The system also helps generate quality reports which assist providers with tracking their own quality measures and goals.

> I guess you have to believe that those quality measures matter and I think they do when it comes down to it. I think on average if we have reasonable control without being too tight on people with high blood pressure and diabetes, then we'll have better outcomes down the line if we do the things we're supposed to do. The things have been proven by proper studies, we're not doing enough, I think the outcomes will be better. (Physician, Practice B)

More channels for communication within the system makes it easier for providers and specialists to collaborate. It also makes it easier for providers to see patients within their own practice even if they are not seeing their normal patients. The practices uses the patient portal as outreach for patients overdue for tests and treatments and physicals.

Unfortunately, the information in the system can be too much. Those drug alerts can be too many for the user and vital alerts can get ignored amongst the "noise". Physician 1 from practice A complained that overall, the system gives "too much information [and] too overwhelming."

5.2.5 Meaningful Use Results

We were able to collect meaningful use Stage 1 measures from the first four SMPP but the fifth practice (Practice I) does not take Medicare or Medicaid patients so they do not have to comply with meaningful use. Of the four affiliated practice, there was no variation between them and they were all able to meet the current meaningful use standards

5.3 Discussion

5.3.1 Themes

Several themes emerged from these interviews. The first is HITs added emphasis on documentation. Many providers complained that documentation has required them to work additional hours to keep up with their documentation duties. Because they are the primary point of contact for the patient and they not paid by the hour, they bear the burden of entering the data into the system. While this adds work for the provider, it does improve Quality of Care because of the extra data entered into the system. SMPP are now able to run quality reports that they would not have been able to do in a paper system. Providers are also able to have a better understanding of the health trends of their patients because of the amount of detailed data collected on their patients.

Another issue is the fact that SMPP cannot be seen as isolated offices that only work within their own HIT system. They are not the only ones seeing to the health of their patients. Their patients go to specialists, labs, and hospitals that may not be part of the SMPP's parent organization. This is especially true for the independent practices that do not belong to any large organization. Those organizations are still using HIT but they may not be compatible and easily integrated. Providers still need to get that information but they cannot rely on their own system and that adds cost to those transactions. In most cases, patient notes are transferred through alternate means such as faxes. In most cases, that adds labor costs because physicians have to sign off on the documents and staff has to scan them and add them to the system. In addition, the added delays in getting that information can cost providers time and delay treatment as they wait for that information.

One independent practice works around this issue by using an electronic fax system that removes the requirement of scanning and makes it easier to attach that information to a patient's chart. This is an issue that needs to be addressed with regards to HIT and SMPP.

Because users are required to use the HIT system and so in these cases, they have little choice in not working with the system. While HIT Quality and the different Impacts seem to influence User Satisfaction, we are not observing any impacts exerted by User Satisfaction. As we show in Chapter 7, we do observe User Satisfaction influencing the decisions of providers to stay in the industry and so User Satisfaction has an indirect influence on HIT use and impact.

In our data collection, compared to the other constructs, we received less data on Workflow and Patient Satisfaction. As far as Workflow, we did see some influence with regards to new procedures for entering data into the system. What we did find though is that these changes to Workflow influence Productivity due to the extra work added by the changes in Workflow. Because we did not include patient interviews or data in our study, we only received minimum indirect measures of Patient Satisfaction. We were only able to get the practice's perception of Patient Satisfaction which may not be as accurate.

5.3.2 Updated SMPP HIT Success Model

Prior literature has studied the effects of HIT on communication and collaboration and has treated these constructs as dependent variables (Beuscart-Zephir et al, 2005; Oborn et al., 2011). From our study, those two constructs are emerging as mediating

constructs that are influenced by HIT quality but they also impact Quality of Care and Operational Performance. Through the messaging features, providers have an easier time consulting with specialists about the health of their patients. Patients have access to their own medical information and have on occasion corrected mistakes through their review. Orders such as prescription refills are done quicker with less effort through the use of e-prescription features. Providers spend less time finding information in a patient's chart. Because of these influences on the original impacts, we have revised our original framework which can be seen in the model below (Figure 9).

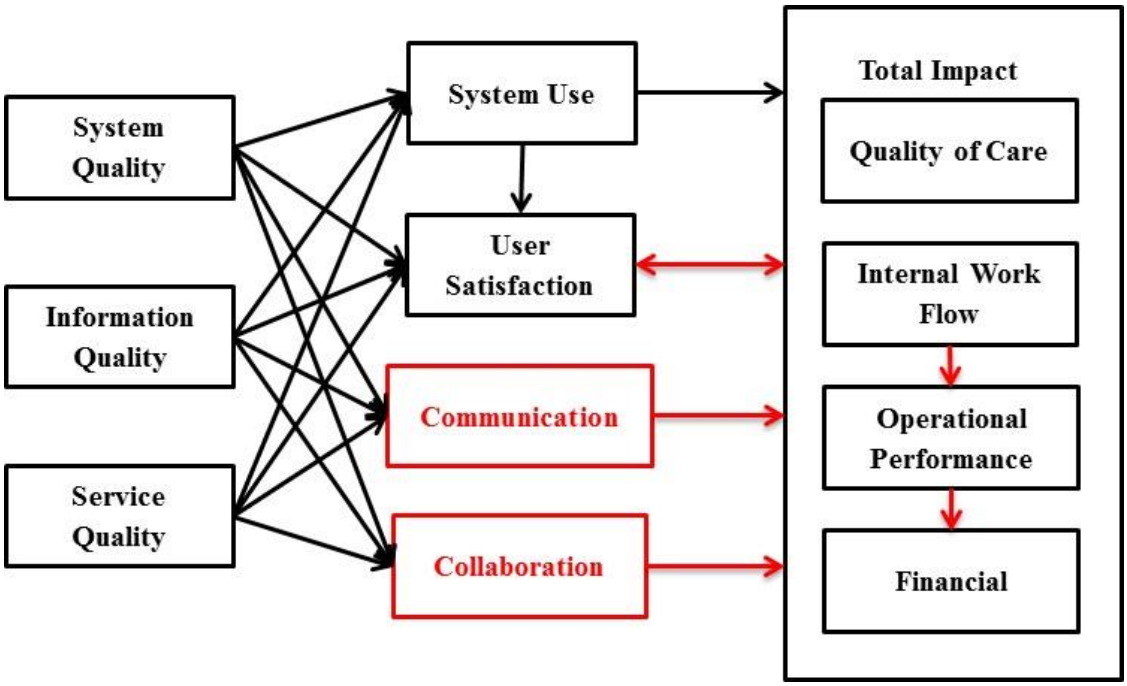

Figure 9. Updated HIT Success Model

The differences between our initial framework and the updated model are highlighted in red. We found ample evidence as shown in the above sections that the

HIT quality does affect System Use, User Satisfaction, Communication, and Collaboration. As the HIT system quality improves, all four of those constructs improve as well.

The largest difference between the framework and the final model is shown in the middle of the model. We found that Communication and Collaboration are not the final outcome with regards to HIT usage but are mediators between HIT Quality and the organizational impacts. The use of communication/collaboration through the HIT system affects all four impacts in our model. Quality of Care is improved through better communications between providers and specialists and also improved through better communication channels such as the patient portal. Communication/collaboration helps internal work flow by giving users another way to assign work to employees such as giving vaccines or setting up referrals. Better communications/collaborations through the HIT system also makes the user more productive by streamlining some orders such as prescription refills and spending less time coordinating phone conferences with specialists. Communication also affects the SMPP Financial performance through streamlined communications with third party payers such as insurance companies and the CMS. By assisting the SMPP with the reimbursement forms, there is less need for resubmission since the system verifies that the forms are completed correctly before allowing the user to send them out.

As per our initial framework, we found that both System Use and User Satisfaction affected the organizational impacts. User Satisfaction had less of an impact as the user was required to use the system regardless of their satisfaction level but their

satisfaction could have an indirect affect as dissatisfied users could leave the SMPP and affect the practice through that loss of labor. User Satisfaction was also affected by the organizational impacts. As the users saw the positive impact of HIT, there were more inclined to perceive the system in a more positive light despite the negative effects in might have had to the user in terms of productivity. What we did not find was an influence of the organizational impacts on the System Use. As mentioned several times, the users in these SMPP are required to use these systems and it does not matter if the use has an impact on the organization, they will still use the HIT system.

We also found that there were some relationships between the various organizational impacts. Work flow will impact Operational Performance both positively and negatively. As some work becomes easier to do such as documenting follow up visits or e-prescribing refills, productivity is increased. As other work becomes harder to do, productivity decreases. This can be seen through the added documentation requirements required by the HIT system. We also found that Operational Performance in terms of productivity also impacts Financial Performance. As users take more time to do their work, the SMPP is impacted financially through added hours for the employee. This can also impact the SMPP positively as users become more productive with other work. This relationship between Operational Performance and Financial Performance is only valid for workers that are paid hourly and does not apply to users that are salaried or paid for per patients such as physicians and other providers.

5.3.3 Future Directions

One future direction that this study could take is take a closer examination at the HIT system and how its interface could be improved. Many participants complained that either the system had too many clicks or was not user friendly. By taking a closer look at how users are actually use the system in their daily work schedule, we could gain a better understanding of how to improve the user interface and increase productivity and user satisfaction.

Because this dissertation did not examine HIT impacts from a patient's point of view, we did not get a clear picture of how the system affects patient satisfaction. This could be extremely crucial to designers of the patient portals and help them create a more user friendly portal. In addition, this could give researchers a better insight on how patient interaction with the HIT system affects their Quality of Care.

5.4 Conclusion

In this chapter, we found that documentation was both a hindrance and a benefit brought on by HIT. Even though it adds more work for the employees of an SMPP, it has shown to have benefits for patients' Quality of Care. We also found that SMPP do not work in a vacuum and must have contact with other medical providers in order to give their patient's better Quality of Care. HIT has helped SMPP communicate better with these outside providers through electronic means of communication which helps streamline medical data transfers. In addition, due to the limitations of this dissertation, we were unable to collect direct data about patient satisfaction. This could be corrected in a latter study. Finally, we were able to update our original HIT Success Framework to

show how Communication and Collaboration have a mediating effect on the different HIT Impacts.

CHAPTER VI

SMPP HIT MATURITY AND ORGANIZATIONAL IMPACT

6.1 Summary

In this chapter, we will focus on the dissertation's second research question: *How does the SMPP's HIT maturity influence the organizational impacts?* Using the HIT Value Hierarchy framework from Chapter 2, we will categorize the different cases according to their maturity of HIT use. We will then discuss how HIT maturity of Use influences the HIT Success framework and discuss how those impacts differ between the SMPP studied. Next we will provide an overview of the themes that emerge from this research question and how our finding have altered our framework. Finally, we will examine future directions for this second research question and summarize the chapter.

6.2 Findings

In this section, we show how HIT Maturity of Use can be categorized for each of the practices. We will also examine how that Maturity of Use has influenced the SMPP impacts and how those impacts compare between each SMPP.

6.2.1 Maturity within each SMPP

All of the practices were able to fulfill their needs for Infrastructure by simply having an HIT system. This study did not select any SMPP that did not have an existing HIT for at least a full year so we were not going to have a case that had not fulfilled the lowest level in the pyramid. Which leads us to second level of Needs and that is fulfilling

Security and Stability. While most of the cases had some intermittent outages, none of the outages reached the level where the SMPP could not properly function. This informs us that all of the cases were able to complete the second level.

The third level of Needs, Integration, was reached by all of the SMPP except Practice C. Practice C was still operating with three different systems: EMR, registration, and scheduling. While there was some integration between the systems, they were not fully integrated and even the clinical side of the practice had to have at least the scheduling and the EMR open at the same time in order to do their work. The other practices (A, B, E, I) were able to fulfill their need for Integration by adopting an HIT system that performed all needed functions within the practice both administrative and clinical.

The original model used Competitive Advantage as the fourth level and prior to data collection, we adjusted the model to change that level to Performance Gains. As we analyzed the data, this level was confounded by the Operational and Financial Performance from the HIT Success Framework. Instead, we had a construct emerge from our analysis that pointed to an alternative Needs level: Inter-Organizational Integration (IOI). IOI is the ability of the SMPP to be integrated with other medical organizations that are involved with their patients. Those organizations include pharmacies, specialists, labs, and hospitals.

Of the four remaining practices, only practice E was able to demonstrate that their achieved the level of IOI. Because of their location and their parent organization, they are able to send and receive most of their medical information outside of their practice

through their system. Most specialists and labs that their patients see are within their parent organization and thus connected with the patient. Not all of the hospitals in the area belong to their parent organization but they are all using the same HIT system and practice E has access to those records.

Practice A is a rural practice that has a parent hospital that is mostly integrated with their practice but they have another hospital that is equally close and on a different system. This prevents them from integrating with that hospital. In addition, most specialists in the area use that hospital's system and cannot communicate directly with Practice A's system.

Practice B, like Practice E, belongs to a large parent organization and uses the same HIT system as Practice E. But, they are geographically located on the outskirts of their parent organization and thus work with patients that see labs and specialists outside their parent organization. In addition, one of the newly acquired local hospitals is not yet on the same HIT system and thus prevents full integration.

Practice I is the one independent practice in this study and does not belong to a parent organization. They do not have hospital privileges and do not have access to any of the hospitals. In addition, they do not share a system with any of the local specialists or labs. They can order electronic prescriptions to most of the pharmacies. In order to mitigate those weaknesses, their system allows them to accept and send electronic faxes. This allows them to accept faxes from outside parties and add those documents to the appropriate charts without the need to scan. They still scan documents in the office but those are limited to work notes and sports physicals for their patients.

6.2.2 Maturity's Influence on SMPP Impacts

In our analysis, we broke our findings into four categories that correspond to the modified HIT Value Hierarchy: Stability, Security, Integration, and IOI. In this section, we will explore how each of these constructs interact with the twelve constructs from the HIT Success Framework. The first construct, Stability, has a direct correlation with System Quality. We were interested in the stability of the system which has an inverse relationship with the occurrences of system outages or System Quality. This in turn affects User Satisfaction and Productivity as users are disgruntled when they have to spend extra time to enter data into the system once it recovers. During system outages, users do not have access to their patient's records and trying to treat the patient without the assistance of their medical history.

We had limited evidence of Security in this study. Some administrative workers talked about using system logs to track down problems in their workflow. Practice E uses logs to observe which medical assistants are slow at certain tasks. The office manager at Practice B uses logs to see if proper procedures are performed:

> One great thing about an electronic medical record is you can view every click that a person has made. Every time they click accept, exit, anything, so it helps us uncover mysteries. Well this patient was seen yesterday but they're telling me that they're not on that medication, why would they say they're not on that medication? Oh, because the CMA yesterday didn't take the time to ask about their medication, they clicked all reviewed before the patient even had arrived. (Office Manager, Practice B)

The next construct, Integration, appears to influence Productivity, Communication, and Quality of Care. Because the messaging application is integrated

into the system, the SMPP has better documentation of any communication surrounding the patient. That documentation could be used later to track what tests, advice, and treatments were given to the patient and give the user better information about what worked and what did not work for that particular patient. In addition, the integration with the various applications within HIT keep the user from having to manually enter data from one section to the next.

Finally, Inter-Organizational Integration (IOI) affects both Productivity and Quality of Care. When the SMPP has full IOI, users do not have to go through extra steps and procedures to transfer medical information from outside the practice into their HIT system. This saves time and labor costs. In addition, information is transferred faster from one office to the next. This can be vital to the patient's health if that information is needed for a proper diagnosis. This was evident when Physician 1 from Practice C complained that in one case, it took 2 weeks to get the Emergency Room records from one of the hospitals outside their parent organization.

6.3 Discussion

In this section, we will provide an overview of the themes that emerge from this research question and how our finding have altered our framework. We will also examine future directions for this second research question.

6.3.1 Themes

One theme that emerged in this study was security's effect on SMPP impacts. Before starting the data collection and analysis, we focused on Stability within the Stability/Security Needs level and almost ignored Security. This was under the

assumption that all HIT systems have security features and we can safely ignore it while focusing on the Stability issue. What appeared is that Security goes beyond the safety of the information from unauthorized personnel but includes information assurance and the ability to look the data and know that it is accurate. Two informants from two different practices using the same system (Practice B and E), use the system logs to not only check on the productivity of their employees but to also check the veracity of the information entered by those employees. This suggests that Security not only has an impact on Information Quality but Productivity and Quality of Care as well.

Another theme that emerged from this study is the need for HIT integration with outside entities. Something that was not mentioned in the literature that we reviewed was the need for SMPP to interact with other medical organizations when administering medical care to their patients. The SMPP is not the only place where their patients go for medical care and that information needs to be available to their primary provider in order to receive the best care possible. These organizations include hospitals, specialists, labs, and pharmacies. Figure 10 shows how SMPP are linked to other medical providers.

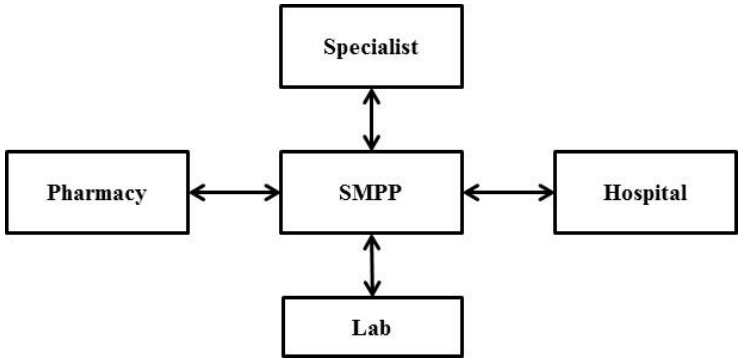

Figure 10. Interorganizational Integration

This is less of an issue for affiliated practices that have some integration with their parent hospital but this is a larger issue for independent practices that do not have hospital privileges and cannot easily obtain patient data from the local hospital. Practice I mitigates some of that disadvantage by implementing a system that allows electronic faxes which helps streamline their data collection from other offices.

In the following section, we show the updated HIT Value Hierarchy and an updated framework for this dissertation.

6.3.2 Updated Framework

The following figure (Figure 11) is the updated HIT Value Hierarchy which replaces the Performance Gains level with the Inter-Organizational Integration (IOI) Needs level.

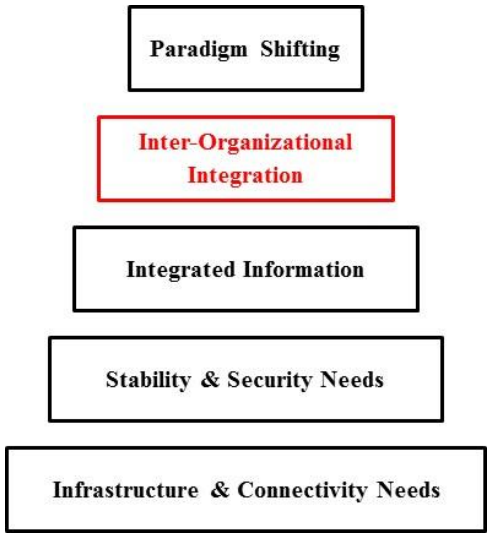

Figure 11. Updated HIT Value Hierarchy

As mentioned earlier in this chapter, the need for integration outside the SMPP is imperative for delivering better quality of care and that level provides some differentiation between practices that have achieved IOI and those that have simply fulfilled the Integration need.

The following figure (Figure 12) provides a summary of how the different constructs in the Maturity Framework interact with the HIT Success Framework. This shows how achieving or not achieving each level of need can affect the HIT Impacts on an SMPP.

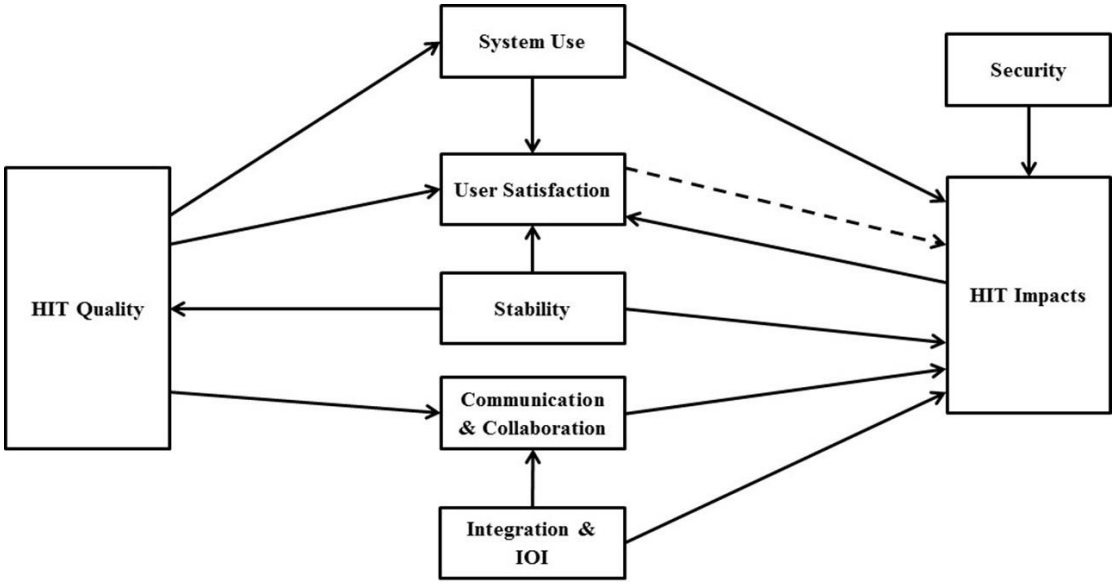

Figure 12. Overall Dissertation Model

The bulk of this model was explained in Chapter 5 with the relationships between HIT Quality, System Use, User Satisfaction, Communication/Collaboration, and HIT Impacts and for brevity sake, we will not repeat those explanations. The purpose of this model is to explain the relationship between HIT maturity and the rest of the HIT Success Model. Originally, we did not know the role of HIT maturity with regards to the HIT success model so we only had a vague relationship between the maturity and the HIT Success Model. After our analysis, we can show how each of the levels in the HIT Value Hierarchy affects the individual constructs in the HIT Success Model.

Of the different Hierarchy levels, Stability influences the most constructs: HIT Quality, User Satisfaction, and HIT Impacts. As shown in the sections above, Stability has a positive relationship with HIT Quality. As the system becomes more stable (i.e., fewer outages), the HIT Quality increases. This does not mean that system may have

other issues such as a badly designed user interface but if the system is not stable, the perceived HIT Quality tends to decrease even more. This also correlates with the User Satisfaction. Users tend to be more satisfied with the HIT system if it is more stable.

The biggest effect of Stability is its influence on the various HIT Impacts. When there are HIT systems outages, users are unable to access the patients' records which can lead to lower quality of care. In addition, this disrupts their work flow and productivity decreases as users have to enter data into the system once it is restored. All of this increases labor costs and affects the SMPP's financial performance negatively.

Security only influences the HIT Impacts in the form of work flow and productivity. Through the use of system logs, administrators have the ability to check on the SMPP employees and their daily work flow. This can help identify problem areas and help administrators remedy issues of productivity through retraining or reallocation of tasks.

Integration influences both Communication, and HIT Impacts. Because the messaging application is integrated into the system, the SMPP has better documentation of any communication surrounding the patient. That documentation could lead to better quality of care as the patients' history can be used for better diagnosis and treatment. Through integration of application, productivity is increased as users no longer have to manually transfer data across platforms.

Finally, Inter-Organizational Integration (IOI) affects HIT Impacts in the form of both Productivity and Quality of Care. When the SMPP has full IOI, users do not have to go through extra steps and procedures to transfer medical information from outside the

practice into their HIT system. This saves time and labor costs. In addition, information is transferred faster from one office to the next. This can be vital to the patient's health if that information is need for a proper diagnosis.

6.3.3 Future Directions

As mentioned before, we did not focus on Security in this study when looking the Maturity of HIT Use but we still found some evidence of how Security can influence the impacts of HIT. One future direction that we can take, is to do a broader study of Security within SMPP and how it affects the individual practices. This could give us insight into how much Security should be emphasized in the practice and how it could be improved to give the SMPP better outcomes.

One physician (Physician 1, Practice A) discussed what he called "Doc in a Box" or medical clinics run out of major chain pharmacies. He complained that their patients may go to those clinics out of convenience but one disadvantage is that their practice has no record of those visits and may not have a complete picture of a patient's history. In addition, the pharmacy run clinic also does not have a full picture of the patient's history and must rely on the information given by the patient. Because of this lack of IOI, patients that go to these clinics may not be receiving the best Quality of Care due to the "holes" in their medical history. One future study that we may perform is to take a closer look at these clinics and examine the extent in which their HIT systems are integrated with local SMPP and how does that impact the SMPP and their patients.

Now that we have a framework for measuring Maturity of HIT Use, we could do another study that collects data from more practices to get a better understanding of

where the majority of these SMPP fit in the model. We can also take that study further and compare the impacts of each SMPP based on their Maturity level. We may find that practices may not be heavily affected by lower levels of Maturity and it may not be beneficial to engineer their practice to a higher level.

6.4 Conclusion

In this chapter, we found Security had a much larger role in HIT impact than we originally thought. HIT Security provided administrators with the ability to improve Information Quality, Productivity, and Quality of Care. We also found the importance of Inter-Organizational Integration (IOI). With the dependence of SMPP on outside medical providers, lines of easy communication will help both Productivity and Quality of Care as it becomes easier to get records from hospitals, labs, and specialists. Finally, this chapter provides an updated HIT Values Framework with the new IOI Needs level.

CHAPTER VII

CASE COMPARISON ACROSS ALL SMPP: PROVIDERS' PERSPECTIVE

To get a better understanding of how HIT use influences organizational impacts, this chapter will provide a summary of our analysis across 9 different cases. Unlike the last two chapters, we will only focus on the providers' perspective and factor in any of the clinical or administrative support. Providers give us a unique perspective because they are the ones that diagnose and treat the patients and are the employees that are most responsible for a patient's Quality of Care. In addition, from our findings in Chapter 5, providers are also the users that use the system the most due to the demands of documentation and thus they are the ones that are negatively affected in terms of Productivity.

7.1 Summary of Providers

We interviewed 11 providers from 9 separate SMPP in order to answer our research questions. Providers were selected based on size of their practice and willingness to participate. We are targeting physicians in southeast region of the US that work in practices that employ 10 or less physicians. We were only selecting practices that have been using HIT for at least one year. The average time for interview was 35 minutes. Table 12 below gives a summary of the participants in this study.

Table 12. Summary of Interviewed Providers

Provider	Practice	Size (in number of providers)	Experience with HIT (in years)	Experience with current HIT	Independent
Physician 1	A	5	8	2 years	No
Physician 2	A	5	7.5	2 years	No
Physician 3	B	6	7	2.5	No
Physician 4	C	7	6	6 years	No
Physician 5	D	8	7	3.5	Yes
Physician 6	E	6	7	2 years	No
Nurse Practitioner 1	E	6	3	10 months	No
Physician 7	F	3	3	2 months	No
Physician 8	G	8	8	4 years	No
Physician 9	H	10	6	2 years	No
Physician 10	I	3	16	7 years	Yes

7.2 Findings

In the following section we will discuss the findings from our interviews. We have broken it up along the constructs from our derived framework (Figure 12).

7.2.1 HIT Quality

HIT has had some influence on SMPP in terms of Service Quality. For major issues such as outages, the IT support responds fast but they are not as responsive for minor issues. For training, most providers received training prior to the rollout and during the actual rollout, the HIT vender had support on site to help transition the physician's office. For some of the offices, a small portion of the providers and staff had extra training so they can help assist others in the office with technical issues.

For Information Quality, the biggest issue was the amount of information found within the system. Some providers complained that there was too much information to sort through especially when it came to the drug interaction and allergy alerts when

ordering prescriptions. There was a fear that they might have missed an alert that was relevant because they got into the habit of ignoring them. The other issue for Information Quality was the lack of quality control with data entry. It was too dependent on the person entering the data and while some providers did a good job of documentation, some providers did a poor job.

> Because [our system] allows for a dramatic amount of personalization there's a wide variety of quality there. So, there can be exceptional quality and there can be bare-bones quality so it really runs across the gamut there. (Physician #6)

This quality control issue was especially true for providers that relied on speech recognition software which makes a lot of errors not corrected by the user. Due to the reliance of scanned files, it can be hard to retrieve those same files if they are mislabeled.

For System Quality, the providers were mostly happy with the system. For most instances, the system are fairly stable and would rarely go down. For some providers, they only see an occasional slowdown of the system. Except in the above instances, finding charts and the information within a chart is easy. Except for two providers, most complained about the system not being intuitive and that there is too many screen changes to get to the right interface.

7.2.2 HIT Use and User Satisfaction

With regards to System Use, most providers use the EMR portion of the system almost exclusively throughout the day. Information within their own practice and their own parent healthcare system can be easily obtained and integrated but any information

outside of their parent organization usually comes in as paper and has to be scanned into their system. In a couple of instances, the provider does work outside of their main practice and has to resort to a paper system.

For User Satisfaction, in all but one interview, the providers rated the system a 3.5 out of 5 or higher. One provider was extremely dissatisfied with the system and rated it a 1 out of 5. The biggest complaint amongst the providers is the added work with extra documentation. This led to two of the providers discussing the fear that providers will leave the profession due to burnout caused by the introduction of HIT and the added work.

> People will be prone to physician burn out and that's not good the profession. What will happen is we'll have more and more physician burn out until no one wants to go to medical school and you don't want anything but the cream of the crop to go to medical school. (Physician #9)

7.2.3 Communication and Collaboration

There were several HIT impacts to Communication. Patient communication has been greatly improved. Patients are able to communicate with the providers through patient portal and get their medical information including lab results from the same place. Patients not signed on to the patient portal of the HIT has their results printed and mailed to them. Communication is more streamlined with pharmacies through e-prescription but there is still some problems with some pharmacies still using a fax system. System is used to get patient data from hospitals, labs, and specialists as long as those organizations are part of the larger health system. Organizations outside of the parent health system

still communicate through alternate means which can delay the delivery of patient information. System messaging has added accountability since each message is kept in the system and can be attached to a patient's chart. Less messages are getting misplaced compared to the paper messaging system that most practices had utilized. System messaging to specialists has actually improved communication because providers can communicate asynchronously and obviates the need to find a time to talk over phone. For more urgent needs, face-to- face and telephony communication is still used.

> I can just communicate with them through the chart. "[I] saw this patient, they said you said such and such. You have these plans, is this scheduled or is there something you want me to do?" and if the doctor is checking their messages they often can get back quicker but you know sometimes they aren't. (Physician #4)

There is less evidence about HIT impact on Collaboration. HIT does provide another channel for providers to consult with specialists through the system about their patient's health. Providers were also able to message one another about patient concerns when examining each other patients.

7.2.4 HIT Impacts

HIT has had some influence on the financial aspects of the SMPP. HIT allows the providers to capture more charges when examining a patient. In some instances, it has made it easier to code those charges. For one practice, they did not trust the system to collect the charges and so they used a parallel paper system to ensure that all charges are captured.

> What it has created is double work so now our coding person at [our practice] requires us to turn in these paper encounter sheets attesting what we did for these patients that have had these procedures. (Physician #7)

While the HIT system is costly, some of the practices do get incentive money from CMS for adopting HIT. In one instance, the practice gets incentive money from a major insurance company for documenting quality measures.

HIT has also impacted the internal work flow of SMPP. Nurses are front loading the data collection with entering the patient's vitals which can be retrieved by the provider without getting the physical document from the nurse. With the advent of scans, most providers have to sign off on all documents before they get scanned and attached to the patient's record. In a couple of instances, the system is used to drive the exam through the use of templates.

HIT has impacted the operational performance of SMPP through its effect on patient satisfaction and productivity. Some patients are dissatisfied with the amount of attention the provider pays to the computer during the visit. Younger patients tend to be more responsive to the patient portal and tend to use it more than the older patients. When changing from one HIT system to another, providers believe that the patients did not notice the change.

> We're here until 7pm every night every night so I don't know I don't think it has that much as we thought it was but probably because patients are more complex there much more information that we're having to turn over. (Physician #1)

The biggest change to productivity is the added documentation required by the system. In most instances, documentation has added 2 hours to a provider's day. During rollout, there is a reduction in productivity but those levels do come back after a month or two. For the most part, providers are still seeing the same number of patients and are spending the same amount of time per patient after HIT adoption. For a couple of providers, they are actually seeing less patients in a day after HIT adoption due to documentation requirements. Some providers have found that the use of templates reduces the amount of time they devote to documentation. Refilling prescriptions is also quicker with the introduction of HIT. When charts are organized well, searching for information is faster compared to a paper chart system. But, when files are mislabeled, documents are harder to find. Scanning also adds more work for the staff.

There are multiple ways in which HIT impacts Quality of Care. Safety has been improved with prescription ordering through the use of alerts for allergies and drug interactions. Sometimes, there can be too many alerts which can be ignored. Some e-prescription features provide a recommended dosage or provide a favorites list for quicker prescription ordering. Safety has also been improved because prescriptions are more legible which leads to less errors when filling them.

> A lot of times we wrote prescriptions before being on the computer, the handwriting is unintelligible and the dosage could be wrong … when you type it in its easier figuring out the prescription so you know it's going to be correct. (Physician #3)

The HIT system forces the provider to document more and provide more details about the patient's health. For the most part, getting that information is easier which can lead to faster diagnosis. In one HIT system, there is an application that gives the provider information about drugs and illnesses which helps in their diagnosis. Quality measures are easier to obtain from the information collected by the providers.

Patient portals within the HIT system also impacts the Quality of Care within an SMPP. They provide an easy channel for patients to interact with their provider and get medical information. The portals are also used as outreach for patients, reminding them of coming vaccines or tests.

7.2.5 HIT Maturity of Use

Chapter 6 gives an overview of the HIT Maturity of Use for the practices in the multiple case study. This section will cover the four providers (Physicians 5, 7, 8, and 9) not mentioned in Chapter 6. Physician 5 is a member of an independent practice. While that practice has a single, full integrated system, they do not have hospital privileges and does not have easy access to the local hospital's records. In addition, they are using an HIT system that is fairly unique to the area and has to retrieve medical information outside of the HIT when working with labs and specialists. This practice would fall under the Integration level of our HIT Value Hierarchy.

Physician 8 works in an SMPP that belongs to the same organization as Practice E with the same HIT system. They belong to same IOI level as Practice E as they are mostly integrated with the local actors in their area.

Physician 9 works in a rural affiliated practice that has full integration within the practice and with specialists within the same parent organization. Unfortunately, they do not have any integration with the local hospital and they are providing a clinical for the government employees in the county and those patients are not added to their system. This practice would fall under the Integration level of our HIT Value Hierarchy.

Finally, Physician 5 seems to be a special case. Their practice and their parent organization had just implemented the HIT system 2 months prior to our interview. While the practice is using the same HIT system as Practices B, E, and G, they have leveraged the system to the fullest at the time of the interview. Their SMPP also interacts with local specialists that are not using their same system so they are not linked with them. Also at the time of the interview, they were unable to work with the other hospitals in the area that are using the same HIT system. This is special case because at the time of the interview, they had only been using the system for a couple of months and my sole informant was disgruntled with the new system.

7.3 Discussion

7.3.1 Lessons Learned from Provider Perspective

HIT has added another level of accountability to an SMPP. Any orders from a provider to a staff member is now documented and as one provider (Physician#10) puts it: "*there's a record so this definitely helps accountability whereas there is no accountability with notes*." This prevents orders from getting "lost" because the order is attached to the patient's chart and to the employee's task list. Another provider uses the HIT system to check on the productivity of his staff. He uses it to find out where there

are inefficiencies so he can make a change to the office. These additions brought about by HIT help SMPP become more manageable and more productive.

Unfortunately, because providers have more of the documentation responsibilities, this has also created a situation where providers can be driven from this career due to burn out. As one provider confided, they know a few providers that have retired early to avoid the added stress of HIT and she would have quit the field too if she could afford it.

7.3.2 Future Directions

This study provides opportunities for future research. First, a study on SMPP provider interaction with HIT could help us better understand how we could improve the HIT interface so that providers can be more productive and be more satisfied with their HIT system.

Second, a follow up study can look at the role of user satisfaction and how organizations can increase that satisfaction. This can be vital with possible threats of providers leaving the business do to their added workload and their dissatisfaction with these HIT systems.

7.4 Conclusion

The goal of this study was to show how the usage of HIT systems influence the organizational impacts on SMPP. To answer this question, we interviewed 11 providers from SMPP. Based on our finding from our interviews, we found that while documentation provides plenty of benefits for quality of care, it is detrimental to the productivity of the provider. We were also able to show that HIT does not just start and

stop at the door of the SMPP. While it is important to have integration within in the practice, the HIT system must also be able to communicate with all organizations that administer medical care to the patient including the hospitals, labs, and specialists. Finally, we were able to show that improved communications should not be an end goal for the implementation of HIT but a tool to improve the different impacts of the organization.

CHAPTER VIII

DISSERTATION SUMMARY AND CONCLUSIONS

The goal of this dissertation was to answer two research questions:

1. *How does HIT usage influence the organizational impacts on small and medium sized physician practices? These impacts include:*
    a. *Quality of Care*
    b. *Internal Work Flow*
    c. *Collaboration and Communication*
    d. *Performance Outcomes*
2. *How does the SMPP's HIT maturity influence each of these impacts?*

Chapters 1, 2, and 3 provided the background and foundation to help us answer those questions. The Methodology chapter discussed how the dissertation was conducted and how the data was analyzed while the next three chapters provided results of the study. In the following section, we will give you a summary of those results followed by the dissertation's limitations. In the last section, we will provide an overview of the implications of this dissertation both theoretical and practical.

8.1 Summary of Study Outcomes

In chapter 5, we found that documentation was both a hindrance and a benefit brought on by HIT. Even though it adds more work for the employees of an SMPP, it has shown to have benefits for patients' Quality of Care. We also found that SMPP do not

work in a vacuum and must have contact with other medical providers in order to give their patient's better Quality of Care. HIT has helped SMPP communicate better with these outside providers through electronic means of communication which helps streamline medical data transfers. In addition, due to the limitations of this dissertation, we were unable to collect direct data about patient satisfaction. This could be corrected in a latter study. Finally, we were able to update our original HIT Success Framework to show how Communication and Collaboration have a mediating effect on the different HIT Impacts.

In chapter 6, we found Security had a much larger role in HIT impact than we originally thought. HIT Security provided administrators with the ability to improve Information Quality, Productivity, and Quality of Care. We also found the importance of Inter-Organizational Integration (IOI). With the dependence of SMPP on outside medical providers, lines of easy communication will help both Productivity and Quality of Care as it becomes easier to get records from hospitals, labs, and specialists. Finally, this chapter provides an updated HIT Values Framework with the new IOI Needs level.

In chapter 7, we were able to show how the usage of HIT systems influence the organizational impacts on SMPP. Based on our finding from our interviews, we found that while documentation provides plenty of benefits for quality of care, it is detrimental to the productivity of the provider. We were also able to show that HIT does not just start and stop at the door of the SMPP. While it is important to have integration within in the practice, the HIT system must also be able to communicate with all organizations that administer medical care to the patient including the hospitals, labs, and specialists.

Finally, we were able to show that improved communications should not be an end goal for the implementation of HIT but a tool to improve the different impacts of the organization.

8.2 Limitations

One limitation with this dissertation is shared with all case studies and that is the small sample size. This can be a problem when analyzing data through statistics but according to Lee (1989), findings can become generalizable through repeated testing. We were able to do this by studying multiple cases and making sure that we had a wide variety in the SMPP that we selected. We studied SMPP that were rural, suburban, and urban. We had four SMPP that were affiliates and one independent SMPP. In addition, we had a variety of SMPP that were at different HIT Maturity levels.

In addition, we only selected SMPP that were located in the southeast region of the US which could limit the generalizability of this dissertation. There may be some cultural differences between the SMPP that we selected and SMPP in other regions of the US. We are also limited in the case selection to those practices willing to participate. This may limit our selection to those practices that are satisfied with their HIT system. While we did see some informant dissatisfaction, we might have missed SMPP that are struggling to successfully implement HIT.

8.3 Implications

8.3.1 Theoretical Implications

In this dissertation, we were able to show that researchers cannot ignore outside influences when they study SMPP. Patients of these practices tend to go outside of the

SMPP for other medical work that includes specialists, hospitals, and labs. The information collected from those organizations is vital if the practice is to provide good Quality of Care. When designing a study in this area, those factors must be addressed.

In our HIT Success Framework, we were able to show how Communication and Collaboration are not the dependent variables that other researchers have observed (Beuscart-Zephir et al, 2005; Oborn et al., 2011) but are mediators for other HIT Impacts such as Financial Performance, Workflow, Quality of Care, and Operational Performance. When examining SMPP impacts, both Communication and Collaboration should be included in those studies.

Unfortunately, the dissertation was not able to show that User Satisfaction has any influence on HIT Impacts. But, our findings suggest that User Satisfaction can have some influence on Providers in terms of staying in the industry. While it is possible that User Satisfaction is not a mediator in this context, it is possible that it could be examined as a dependent variable if organizations are trying to retain providers if HIT is employed.

This dissertation also has implications with regards to SMPP Maturity of Use. As we mentioned above, we found that SMPP are part of a much larger value chain so if HIT Maturity of Use is the focus of future studies, Inter-Organizational Integration (IOI) is one factor that needs to be considered. As shown in this dissertation, IOI has some influence on both Quality of Care and Operational Performance.

The above findings provide us with an updated framework that can best explain HIT use within SMPP and provide an explanation of how HIT maturity of use influences the organizational impacts. By providing evidence of the influence of IT maturity on

organizational impacts, we hope to spur further research into this area. This should provide a foundation for further explanatory research in terms of qualitative studies and theory validation in terms of quantitative research. Finally, this will not only help better inform HIT research but we also hope that this dissertation will also help inform IT maturity research within other small organizations in other industries.

8.3.2 Practical Implications

Our findings should provide policy makers with a better understanding of HIT use n SMPP which should help them create better guidelines for its use. By providing examples from various SMPP in the region, we were able show what works and what does not work in terms of HIT use. We also hope that this will better inform policy makers within independent SMPP with regards to training and system selection. This should also inform policy makers in large healthcare organizations that employ affiliated SMPP.

This dissertation should also help inform HIT system designers. By highlighting the issues that HIT users face when using existing systems, designers can address these shortcomings in their future designs. We also intend to show the importance of quality and its influence on organizational outcomes and spur better quality systems and better managed data within those systems.

The dissertation also provides justification for SMPP to adopt HIT systems. By providing evidence of the impact of HIT system use on organizational outcomes, we hope to show wavering SMPP that HIT can provide benefits and how it can provide them. By examining HIT maturity within SMPP, we can also show practitioners that improved use

of HIT will improve organizational impacts. With more HIT experience, organizations can gain better performance (Francalanci & Morabito, 2008; Raymond et al., 1995) and receive better returns on their IT investments.

There are a few recommendations that we can offer to practitioners. First, encourage the HIT venders to provide electronic fax capabilities. The independent SMPP, Practice I, had that capability for their HIT system and it helped mitigate some of the integration issues that other practices encountered. It did not matter if the outside organizations did not have the same HIT system, as long as that organization faxed the results to the SMPP, it was received electronically and was seamlessly added to the patients' charts. This took away the need to scan the document in order to add it to the system.

Second, a couple of the SMPP in our study were notified through the system when their patient was released from the local hospital. This only occurred if the patient was received by a hospital that was within the same organization as the SMPP. Patients that were discharged from another hospital outside of the parent organization did not have the same benefits. This could be mitigated if the hospital kept a list of patient names and the SMPP that they go to so if they are released from the hospital, it will be easier to notify the SMPP that are outside the hospital's health system. This could be the responsibility of the SMPP to register their patients' names with the hospital and keeping that list up to date which could be easily done through an HIT system.

Third, there were several complaints about the interface of the HIT system. This could be remedied through a couple of recommendations. There were some comments

about how the training examples did not fit the actual workflow of a patient's exam and did not feel realistic. These trainings should be tailored for these providers and be more realistic and cover a common exam such as a sore throat complaint. This will help the providers get familiar with the system in a more common setting. Continuing educations could also help mitigate problems with interface issues. By having users take mandatory classes after implementation and after using the system for a month could help users with common problems that that they are facing in their day to day workflow. After using the system for a while, they know what they do not know and can ask better questions in training that are more tailored for their workflow. They also have an opportunity to learn new techniques that will help them be more productive such as short cuts that they may not have had to time to learn while at work.

Another way to remedy the problems with the interface can start with the designers of the various HIT systems. By recruiting SMPP and getting feedback from the various users, they can collect data to make the HIT interface more user friendly. To get cooperation from the SMPP, they can offer discounts on the software in exchange for feedback.

Finally, another issue that was voiced, was the problem of overloaded providers. They tend to work past their normal hours in order to complete their documentation duties and has been reported in some cases, it has led to provider burnout. This could be mitigated through our recommendations above by giving providers more training or by improving the interface. Another way to remedy this is through the addition of more labor by means of hiring transcribers to take providers' audio notes and entering them

into the system. This frees up the provider to examining more patients and spending less time in front of a computer. The use of HIT has reduced the amount of personnel needed in the SMPP front office. With no paper charts, there is no need for a dedicated records person or other personnel that was needed for those duties. Those spots could be filled with personnel that are responsible for collecting and transcribing providers' audio notes thus reducing the need for a highly trained provider to do data entry.

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APPENDIX A

IRB APPROVAL

From: **IRB** <ori@uncg.edu>
Date: Fri, Apr 25, 2014 at 11:35 AM
Subject: IRB Notice
To: sawallac@uncg.edu
CC: irbcorre@uncg.edu, lsiyer@uncg.edu

To: Steven Wallace
Information Systems and Supply Chain Management

From: UNCG IRB

Date: 4/25/2014

RE: Notice of IRB Exemption
Exemption Category: 2.Survey, interview, public observation
Study #: 14-0080
Study Title: HIT Maturity impacts on Small and Medium Sized Physician Practices

This submission has been reviewed by the IRB and was determined to be exempt from further review according to the regulatory category cited above under 45 CFR 46.101(b).

Study Description:

This multiple case study will examine the impact of Health Information Technology (HIT) on Small and Medium sized Physician Practices (SMPPs). While there have been several studies on HIT impact on hospitals and other large medical facilities, there has been little research done on SMPPs. Furthermore, we are interested on how the IT maturity has influenced HIT impact on SMPPs. We anticipate that this study will give researchers a better insight as to how HIT affects these practices. Furthermore, this study should give practitioners a better understanding of best practices with regards to HIT use.

Investigator's Responsibilities

Please be aware that any changes to your protocol must be reviewed by the IRB prior to being implemented. Please utilize the most recent and approved version of your consent

form/information sheet when enrolling participants. The IRB will maintain records for this study for three years from the date of the original determination of exempt status.

Signed letters, along with stamped copies of consent forms and other recruitment materials will be scanned to you in a separate email. **Stamped consent forms must be used unless the IRB has given you approval to waive this requirement.** Please notify the ORI office immediately if you have an issue with the stamped consents forms.

Please be aware that valid human subjects training and signed statements of confidentiality for all members of research team need to be kept on file with the lead investigator. Please note that you will also need to remain in compliance with the university "Access To and Retention of Research Data" Policy which can be found at http://policy.uncg.edu/research_data/.

CC:
Lakshmi Iyer, Info Sys and Supply Chn Mngmt

APPENDIX B

INTERVIEW QUESTIONS

The interview questions are broken into to two groups. The first group of questions is given to all participants in the study as it pertains to their perception of HIT and their organization. The second set of questions is a series of yes/no questions that will be given to a single participant in the study that is familiar with Meaningful Use and how their organization complies to Meaningful Use Metrics. Since this is a measure for the organization, it only needs to be answered once.

Individual Interview Questions Given to All Participants

Demographics

1. What is the size of this practice in terms of staff?
2. What is the break down in roles? i.e. How many
    a. Physicians
    b. Nurses
    c. Physician assistants
    d. Administrative Staff
    e. Others _____
3. How long have you been with this practice?
4. What is your position within the practice?
5. Have you always worked in a similar sized office? _ Yes _No

    a. If not, how is your experience in this practice different from your experiences at past practices?

6. How long have you worked in this career?
7. What is your experience with HIT?
    a. Did you participate in the selection of your organization's HIT systems?Did you receive training prior to the HIT's implementation?
    b. Was your workload reduced during the HIT implementation's initial phases?

HIT and Maturity

1. Which HIT applications are you currently using?
    a. What HIT applications or features do you use the most? (every encounter, every day, how regularly?)
2. Are these HIT applications integrated with one another? Can you transfer data between different HIT applications?
3. Are there any tasks/processes completed on paper rather than within the HIT applications?
    a. Why are those tasks/processes not incorporated into the HIT system?
4. How is the quality of the IT support?
5. Is the system ever down unexpectedly?
    a. How long does it stay down?
    b. How often?
6. How is the quality of the information that you retrieve from the system?

7. Does it take you long to retrieve that information?
8. Are you satisfied with the system as a whole?
    a. What would you like changed?
9. How often do you interact with the system?
    a. Which applications do you use?
10. Do you use HIT to interact with patients?
    a. Scheduling?
    b. Prescribing and refills?
    c. Quesitons?

Table 13. HIT Applications

Name of HIT System			
Type (such as CPOE, EMR, Telehealth, etc..)			
How is it used? Has that use changed over time? Has it affected the office's efficiency?			
How long has it been used?			
Has the application changed in recent years? If yes, how and what is the impact?			
What kind of training and who administered it?			
How was it implemented? Was it gradual or was it a sudden switch over?			

Impact

**** If answer to question #2 in HIT and Maturity section is no, ask the following questions for each application named in previous section; otherwise, the questions refer to the whole HIT system ****

1. In general, how has the staff received the introduction of this HIT system/application in this practice?
2. How has the practice changed the way staff (both administrative and clinical) interacts with one another?
    a. Has there been more collaboration/cooperation amongst the staff?
    b. Has the way the staff communicates with one another changed?
3. Has the system/application helped communication with other offices?
    a. With local pharmacies?
    b. With laboratory reports?
    c. With the local hospital?
    d. With other physician practices?
4. Does this system/application require patient interaction with the HIT system/application?
5. How have the patients received the introduction of this HIT system/application in this practice?
6. Did the office have to make any changes to the workflow with the introduction of this HIT system/application?
    a. If yes, how did it change?

7. How is the current patient records used? Are past notes used during the examination?
8. Does the HIT system/application assist in the decision making process regarding patient care?
    a. If yes, how so?
9. How do you define quality of care? How does the HIT system/application affect a patient's quality of care?
10. How does the HIT system/application affect patient safety?
    a. Has it reduced the number of errors?
    b. Has it helped highlight the any drug allergies or issues with drug interactions?
    c. Does the system assist the office with refilling prescriptions and reminding patients about
11. Have there been any financial implications from the use of the HIT system/application?
    d. In the form of time spent on case load?
    e. In the form of seeing more patients?
    f. In quicker payments from either patients or third party providers?
    g. In time spent per patient visit?
    h. In overall productivity?
    i. In improving administrative tasks?
    j. In improving follow-up visits with patients?

Meaningful Use

1. Does the health care information system assist in compliance with the 15 core objectives of the Meaningful Use matrix?
2. Does the health care information system assist in compliance with the 5 additional objectives of the Meaningful Use matrix?
3. What are the 6 Clinical Quality Measures addressed through the health care information system?

Table 14. Meaningful Use Questionnaire

Health Outcomes Policy Priority	Stage 1 Objective	Objective Addressed	
Improving quality, safety, efficiency, and reducing health disparities	Use CPOE for medication orders directly entered by any licensed healthcare professional who can enter orders into the medical record per state, local, and professional guidelines	Yes	No
	Implement drug-drug and drug-allergy interaction checks	Yes	No
	EP Only: Generate and transmit permissible prescriptions electronically (eRx)	Yes	No
	Record demographics: preferred language, gender, race, ethnicity, date of birth, and date and preliminary cause of death in the event of mortality in the eligible hospital or CAH	Yes	No
	Maintain up-to-date problem list of current and active diagnoses	Yes	No
	Maintain active medication list	Yes	No
	Maintain active medication allergy list	Yes	No
	Record and chart vital signs: height, weight, blood pressure, calculate and	Yes	No

	display BMI, plot and display growth charts for children 2-20 years, including BMI	
	Record smoking status for patients 13 years old or older	Yes No
	Implement one clinical decision support rule and the ability to track compliance with the rule	Yes No
	Report clinical quality measures to CMS or the States	Yes No
Engage patients and families in their healthcare	Provide patients with an electronic copy of their health information (including diagnostic test results, problem list, medication lists, medication allergies, discharge summary, procedures), upon request	Yes No
	Provide clinical summaries for each office visit	Yes No
Improve care coordination	Capability to exchange key clinical information (ex: problem list, medication list, medication allergies, diagnostic test results), among providers of care and patient authorized entities electronically	Yes No
Ensure adequate privacy and security protections for personal health information	Protect electronic health information created or maintained by certified EHR technology through the implementation of appropriate technical capabilities	Yes No
Health Outcomes Policy Priority	**Stage 1 Objective**	**Objective Addressed**
Improving quality, safety, efficiency, and reducing health disparities	Implement drug-formulary checks	Yes No

	Incorporate clinical lab-test results into certified EHR technology as structured data	Yes No
	Generate lists of patients by specific conditions to use for quality improvement, reduction of disparities, research or outreach	Yes No
	Send reminders to patients per patient preference for preventive/follow-up care	Yes No
Engage patients and families in their healthcare	Provide patients with timely electronic access to their health information (including lab results, problem list, medication lists, medication allergies) within 4 business days of the information being available to the EP	Yes No
	Use certified EHR technology to identify patient-specific education resources and provide those resources to the patient, if appropriate	Yes No
Improve care coordination	The EP, eligible hospital or CAH who receives a patient from another setting of care or provider of care or believes an encounter is relevant should perform medication reconciliation	Yes No
	The EP, eligible hospital or CAH who receives a patient from another setting of care or provider of care or refers their patient to another provider of care should provide a summary of care record for each transition of care or referral	Yes No
Improve population and public health	Capability to submit electronic data to immunization registries or Immunization Information Systems and actual submission in accordance with applicable law and practice	Yes No
	Capability to submit electronic syndromic surveillance data to public health agencies and actual submission in accordance with applicable law and practice	Yes No

Core Set of Clinical Quality Measures		
NQF Measure Number & PQRI Implementation Number	**Clinical Quality Measure Title**	**Chosen Measure**
NQF 0013	Hypertension: Blood Pressure Measurement	Yes No
NQF 0028	Preventive Careand Screening Measure Pair: a) Tobacco Use Assessment, b) Tobacco Cessation Intervention	Yes No
NQF 0421 PQRI 128	Adult Weight Screening and Follow-up	Yes No
NQF Measure Number & PQRI Implementation Number	**Clinical Quality Measure Title**	**Chosen Measure**
NQF 0024	Weight Assessment and Counseling for Children and Adolescents	Yes No
NQF0041 PQRI 110	Preventive Care and Screening: Influenza Immunization for Patients50 Years Old or Older	Yes No
NQF 0038	Childhood Immunization Status	Yes No
Clinical Quality Measure Title		**Chosen Measure**
1. Diabetes: Hemoglobin A1c Poor Control		Yes No
2. Diabetes: Low Density Lipoprotein (LDL) Management and Control		Yes No
3. Diabetes: Blood Pressure Management		Yes No
4. Heart Failure (HF): Angiotensin-Converting Enzyme (ACE) Inhibitor or Angiotensin Receptor Blocker (ARB) Therapy for Left Ventricular Systolic Dysfunction (LVSD)		Yes No
5. Coronary Artery Disease (CAD): Beta-Blocker Therapy for CAD Patients with Prior Myocardial Infarction (MI)		Yes No

6. Pneumonia Vaccination Status for Older Adults	Yes No
7. Breast Cancer Screening	Yes No
8. Colorectal Cancer Screening	Yes No
9. Coronary Artery Disease (CAD): Oral Antiplatelet Therapy Prescribed for Patients with CAD	Yes No
10. Heart Failure (HF): Beta-Blocker Therapy for Left Ventricular Systolic Dysfunction (LVSD)	Yes No
11. Anti-depressant medication management: (a) Effective Acute Phase Treatment, (b)Effective Continuation Phase Treatment	Yes No
12. Primary Open Angle Glaucoma (POAG): Optic Nerve Evaluation	Yes No
13. Diabetic Retinopathy: Documentation of Presence or Absence of Macular Edema and Level of Severity of Retinopathy	Yes No
14. Diabetic Retinopathy: Communication with the Physician Managing Ongoing Diabetes Care	Yes No
15. Asthma Pharmacologic Therapy	Yes No
16. Asthma Assessment	Yes No
17. Appropriate Testing for Children with Pharyngitis	Yes No
18. Oncology Breast Cancer: Hormonal Therapy for Stage IC-IIIC Estrogen Receptor/Progesterone Receptor (ER/PR) Positive Breast Cancer	Yes No
19. Oncology Colon Cancer: Chemotherapy for Stage III Colon Cancer Patients	Yes No
20. Prostate Cancer: Avoidance of Overuse of Bone Scan for Staging Low Risk Prostate Cancer Patients	Yes No
21. Smoking and Tobacco Use Cessation, Medical Assistance: a) Advising Smokers and Tobacco Users to Quit, b) Discussing Smoking and Tobacco Use Cessation Medications, c) Discussing Smoking and Tobacco Use Cessation Strategies	Yes No

22. Diabetes: Eye Exam	Yes No
23. Diabetes: Urine Screening	Yes No
24. Diabetes: Foot Exam	Yes No
25. Coronary Artery Disease (CAD): Drug Therapy for Lowering LDL-Cholesterol	Yes No
26. Heart Failure (HF): Warfarin Therapy Patients with Atrial Fibrillation	Yes No
27. Ischemic Vascular Disease (IVD): Blood Pressure Management	Yes No
28. Ischemic Vascular Disease (IVD): Use of Aspirin or Another Antithrombotic	Yes No
29. Initiation and Engagement of Alcohol and Other Drug Dependence Treatment: a) Initiation, b) Engagement	Yes No
30. Prenatal Care: Screening for Human Immunodeficiency Virus (HIV)	Yes No
31. Prenatal Care: Anti-D Immune Globulin	Yes No
32. Controlling High Blood Pressure	Yes No
33. Cervical Cancer Screening	Yes No
34. Chlamydia Screening for Women	Yes No
35. Use of Appropriate Medications for Asthma	Yes No
36. Low Back Pain: Use of Imaging Studies	Yes No
37. Ischemic Vascular Disease (IVD): Complete Lipid Panel and LDL Control	Yes No
38. Diabetes: Hemoglobin A1c Control (<8.0%)	Yes No

Data Quality

Each item listed below is a data quality characteristic which the American Health Information Management Association's (AHIMA) has determined can serve as the basis

for establishing data quality standards. Please read the definition for each characteristic and determine if the health care information system utilized in your organization includes functionalities to assist with the characteristic. Then select YES or NO as appropriate.

Table 15. Data Quality Questionnaire

AHIMA Data Quality Management Characteristics		
Characteristic	**Definition**	**System functionality?**
Data accuracy	Data are the correct values and are valid	Yes No
Data accessibility	Data items should be easily obtainable and legal to collect	Yes No
Data comprehensiveness	All required data items are included. Ensure that the entire scope of the data is collected and document intentional limitations	Yes No
Data consistency	The value of the data should be reliable and the same across applications	Yes No
Data currency	The data should be up-to-date.	Yes No
Data definition	Clear definitions should be provided so that current and future data users will know what the data mean. Each data element should have clear meaning and acceptable values	Yes No
Data granularity	The attributes and values of data should be defined at the correct level of detail.	Yes No
Data precision	Data values should be large enough to support the application or process	Yes No
Data relevance	The data are meaningful to the performance of the process or application for which they are collected	Yes No
Data timeliness	Timeliness is determined by how the data are being used and their context.	Yes No